MAY 1961

Welding Design & Fabrication

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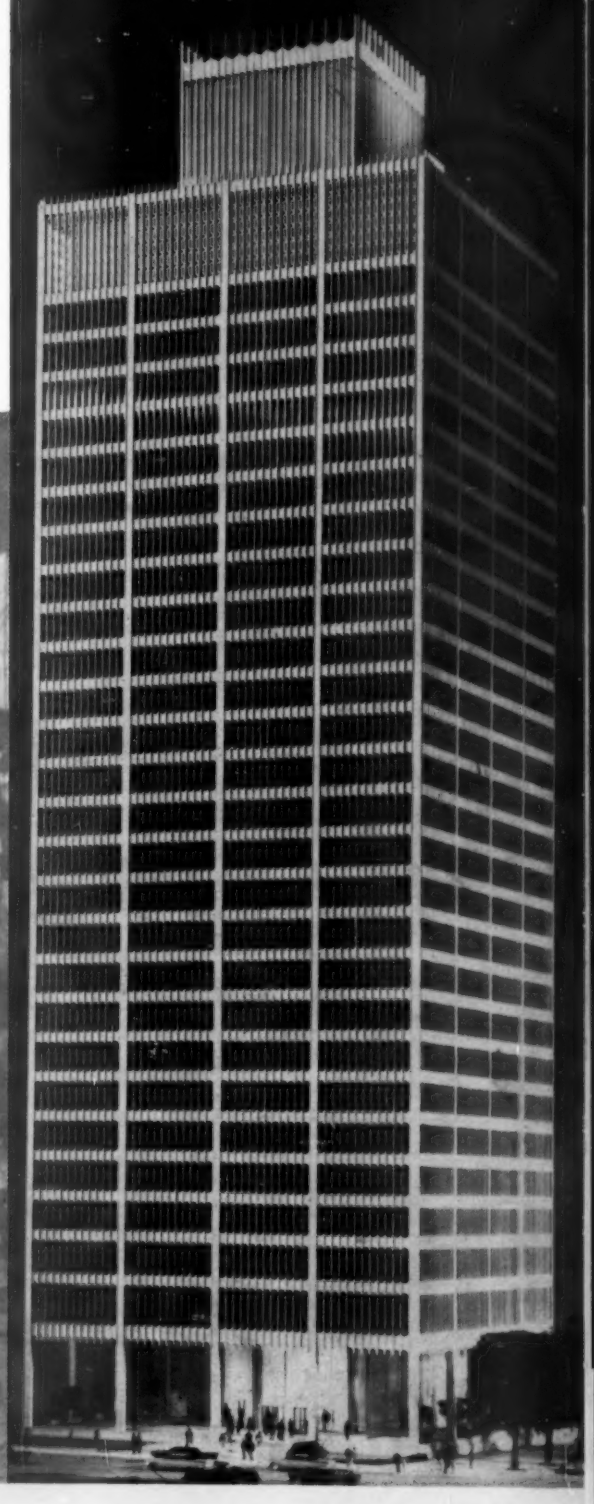

INDUSTRIAL PUBLISHING CORPORATION MAGAZINE

COMPLETE COVERAGE OF THE SIXTH ANNUAL DESIGN ENGINEERING SHOW & CONFERENCE

COBO HALL • DETROIT • MAY 22-25

Which is for YOU?

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LARGE	A-3 & ST-5	3/8"	375 450	2/0 3/0	65%
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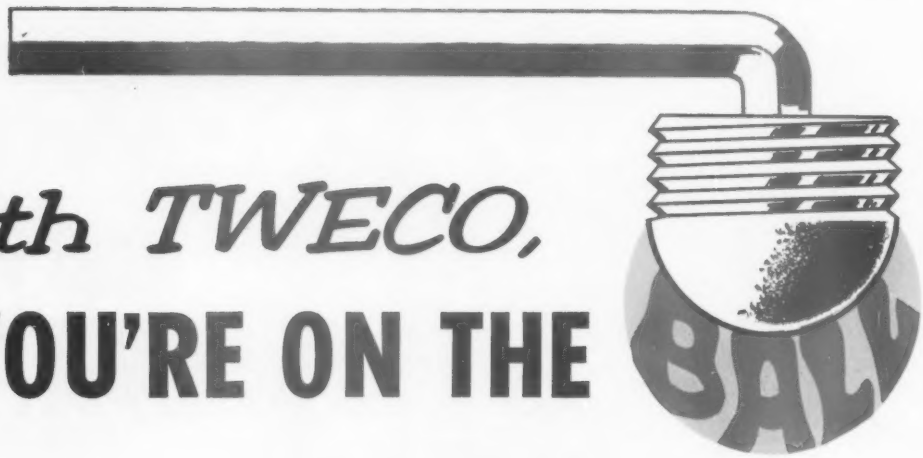

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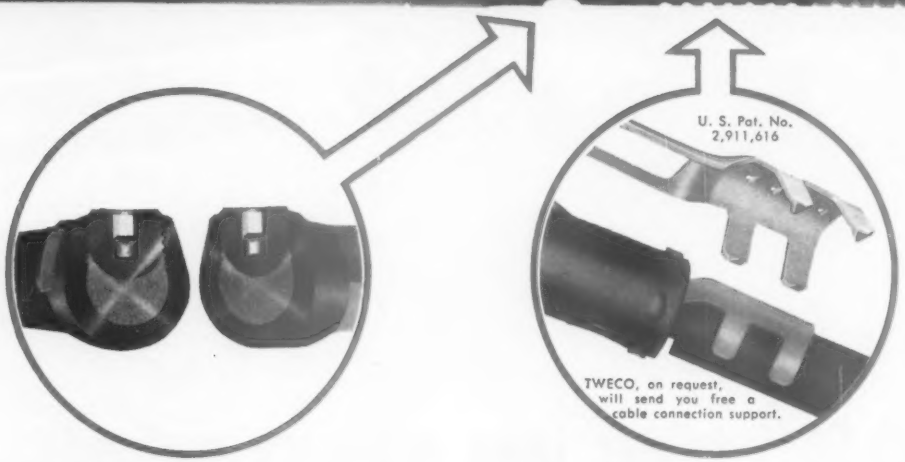

TWECOTONG'S BALL-POINT CONNECTION exerts high pressure on every cable strand guaranteeing 100% electrical and thermal conductivity for cool running and long life. Bare the cable end 1", insert in Ball-Point Connection socket, then tighten Ball-Point screw with strong 7/32" hexagon wrench. Do it in less than 2 minutes — EASY.

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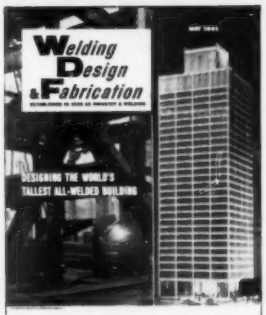

for May, 1961

COVER: The 435-foot Michigan Consolidated Gas Company building will have every part of its wind-resisting system welded. It's appropriate that this all-welded building is being built this year in Detroit, the site of the 1961 Design Engineering Conference. And it's appropriate that the article of the design of this building should introduce a series of statements by leading designers and welding engineers on how welded design has affected their industries. Page numbers are listed below.

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FEATURES

31 DESIGNING THE WORLD'S TALLEST ALL-WELDED BUILDING
Every part of this new building's wind-resisting system will be welded. In field welding alone, it will contain the equivalent of 40 miles of 5/16-inch fillet welds.

SPECIAL REPORT **HOW HAS WELDED DESIGN AFFECTED AMERICAN INDUSTRY?**
Designers and welding engineers from representative American industries tell how their industries have been affected by welding design.

35 BUILDINGS: Peter P. Petkoff, Smith, Hinchman & Grylls Associates, Inc.

36 FREIGHT CARS: W. C. Boese, Pullman Standard Division of Pullman Incorporated

37 AIRCRAFT: Vene L. Darby, North American Aviation's Los Angeles Division

37 HIGHWAY BRIDGES: Craig P. Hazelet, Hazelet & Erdal

38 AUTO INDUSTRY: Carl W. Cenzer, American Motors Corp.

39 STRUCTURAL STEEL: Arsham Amirikian, Department of the Navy

40 PETROLEUM REFINING: George Vest, Arthur G. McKee & Company

40 SHIPS: Frank Pavlik, Sun Shipbuilding & Dry Dock Co.

45 BOILERS: Anthony R. Mellini, Babcock & Wilcox Company

46 HEAVY MACHINERY: M. J. Shoelson, Clearing Division, U. S. Industries, Inc.

47 HOME APPLIANCES: Richard E. Gould, Frigidaire Division, G.M.C.

48 WANTED: WELDS WITH 100,000-PSI YIELD STRENGTH
The rules for welding intermediate strength and mild structural steel do not apply when you build a bridge of heat-treated, high-strength constructional alloy steel.

50 FABRICATOR USES POSITIONERS, WELDS 35% FASTER
Morgan Engineering Company uses positioned welding to keep competitive. They find it's faster than unpositioned welding and gives better quality welds.

52 WHERE DOES YOUR STATE STAND ON BOILER AND PRESSURE VESSEL LAWS?
The author explains the need for uniform code laws and how his organization helps lawmakers enact these laws and keep them up-to-date.

56 AUTOMATIC WELDING SOLVES 5 PROBLEMS
A welding supply distributor works with a customer to improve welding quality and increase production of dust work for heating and air conditioning.

58 CO_2 PLUG WELDING IS 95% FASTER
Plug welding with coated electrodes used to take 78 seconds per weld. Now it's done in 4 seconds with semi-automatic CO_2 welding with a flux-cored electrode.

61 FRENCH JET IS DESIGNED FOR SPOT WELDING
A French aircraft manufacturer gives four important reasons why they use spot welding on their twin-jet plane.

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Your king-size weldment problems can be solved with Lewis king-size facilities and experience. We specialize in weldments from 1 to 35 tons and Lewis integrated facilities offer you complete design, welding and machining service for even the largest weldments.

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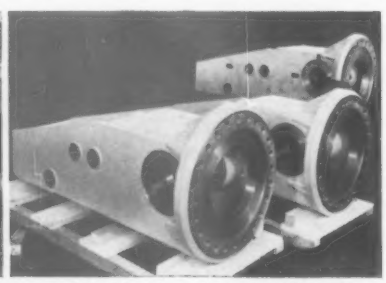

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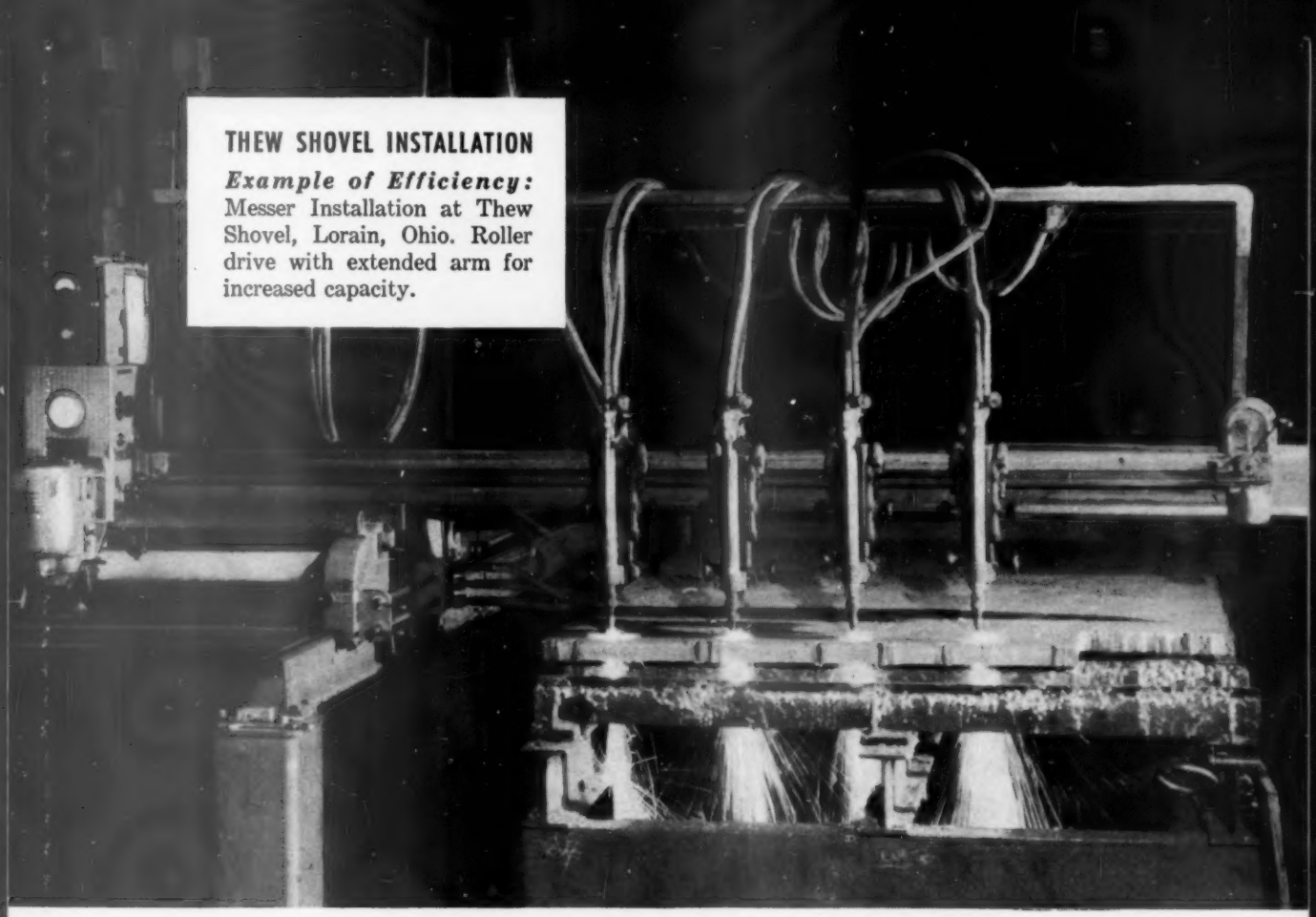

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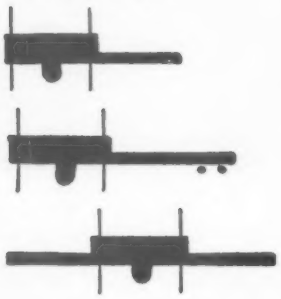

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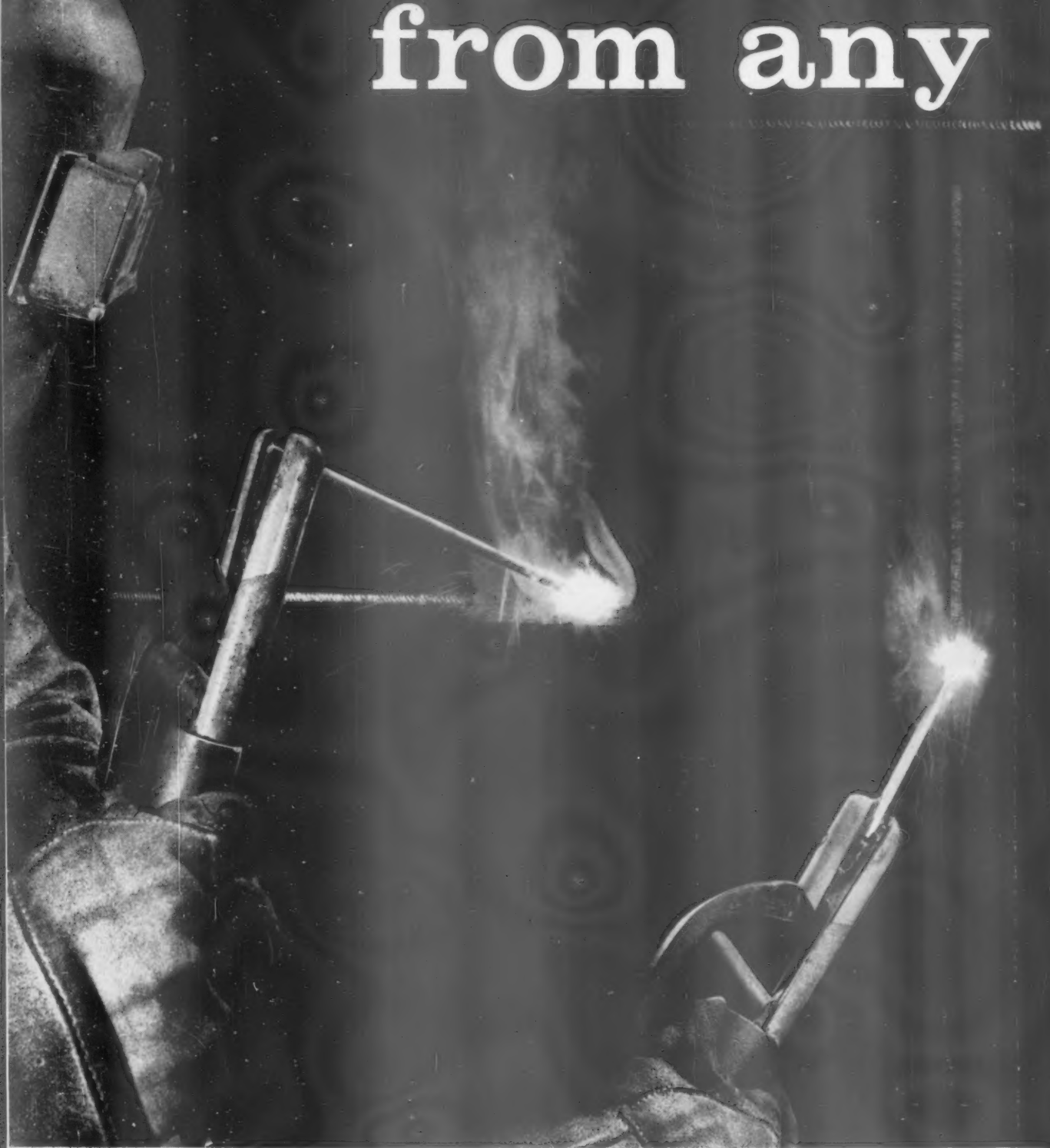

HORIZONTAL — **Try the new SW610 on single and multipass fillets and you'll find it superior to any electrode in its class. A less convex bead, due to better wetting action with sufficient throat reinforcement to prevent cracking . . . a quieter, smoother arc, producing far less spatter . . . a stronger coating crater or flux crucible for better arc direction and deeper penetration. From the standpoint of value — greater operator appeal and higher deposition efficiencies, resulting in less cost per pound of deposited metal.**

VERTICAL DOWN — **Here's where the SW610 is really in a class by itself. It's the only E6010 electrode capable of depositing a vertical down stringer pass free of pits. And this really "shows up" where x-ray checking is required. This advantage, coupled with its strong coating crater and deep penetration, makes the SW610 a natural for pipe welding. From the standpoint of value — rejects and rework time are reduced to an absolute minimum, especially when radiographic requirements must be met.**

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The new A. O. Smith SW610 outperforms any electrode in the E6010 class. In fact, it's so good in all positions that you might say it's in a class by itself.

You get all this with the SW610: Strong coating crater for good arc direction . . . greatest resistance to breakdown . . . no pitting in the vertical down position . . . smoother metal transfer for maximum operator appeal . . . deep penetration for rough jobs . . . better wetting action, producing less undercut . . . less spatter, resulting in reduced cleaning time.

Welds too good to be true. All you have to do to test the SW610 is to send for free sample electrodes. Or get in touch with the A. O. Smith representative near you.

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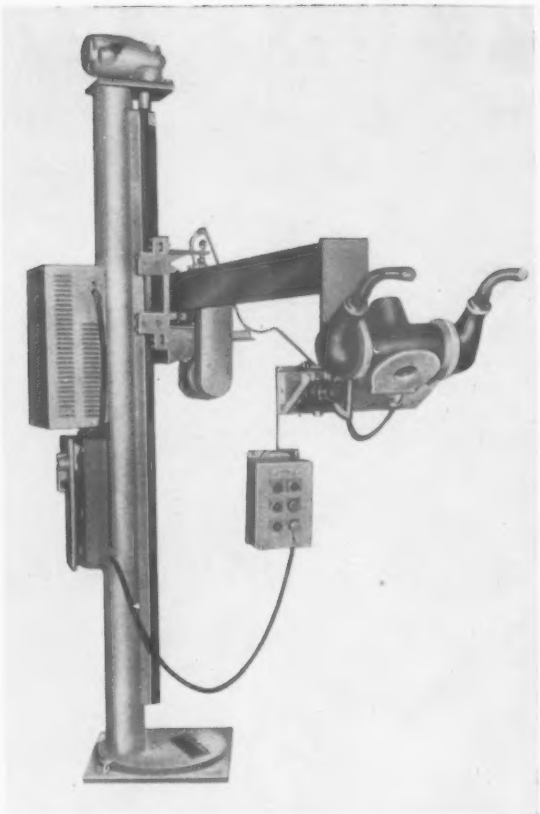


Manipulator positions x-ray head

OAK RIDGE, TENNESSEE: A slightly modified Ransome Model 66 welding head manipulator is being used to position a Picker X-Ray head for the Union Carbide Nuclear Research Division. Union Carbide wanted to be able to move an X-ray head 6 feet vertically and 6 feet horizontally, as well as to rotate it 90° from horizontal to vertical, and 90° from side to side—all by remote control.

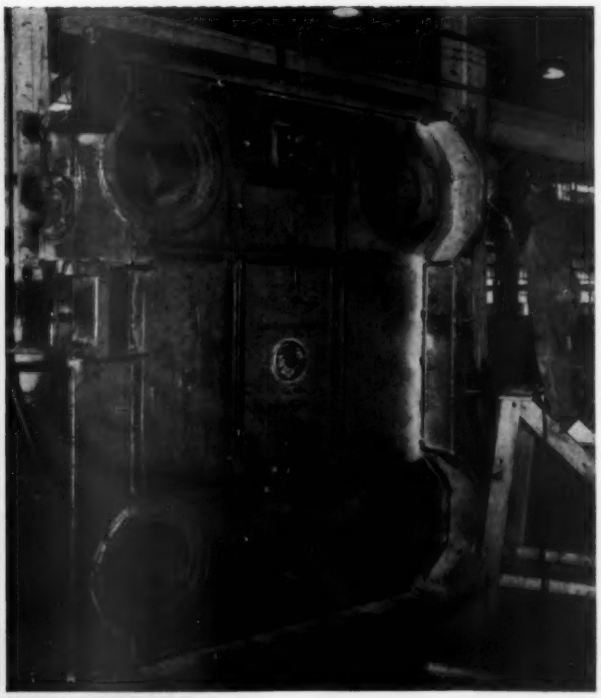
Ransome mounted a small motor-operated positioning device on the end of a standard Model 66 welding head manipulator ram. The positioning device rotates the X-ray head while the manipulator moves it horizontally and vertically.

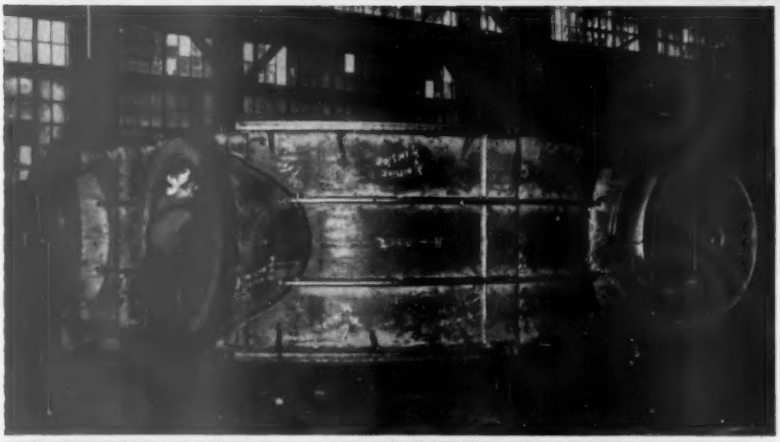
Welded nuclear reactor grid plate

MILWAUKEE: The interesting pattern above shows the stainless steel insert being welded in a nuclear reactor grid plate that goes at the bottom of a reactor vessel. It is being constructed by Allis-Chalmers' West Allis Works for Northern States Power Company's Pathfinder plant near Sioux Falls, S. D.

First, one pass of weld, using inert gas process with filler metal, was deposited on each plate of the grid sandwich.

Second, the groves are finish welded, and machined. This type construction minimizes stresses caused by radiation heat.





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Tensile Strength, psi	115/135,000
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Notch toughness at exceptionally low temperatures	

CHEMICAL COMPOSITION

Carbon	.15/.20
Manganese	.80/1.10
Phosphorus, max.	.035
Sulphur, max.	.040
Silicon	.50/.80
Chromium	.50/.80
Molybdenum	.18/.28
Zirconium	.05/.15

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Aluminum Company of America	721
Armco Steel Corporation	409
Beryllium Corporation	520
Curtiss-Wright Corp.	1219
E. I. du Pont de Nemours & Co.	860
Falstrom Company	821
Handy & Harman	516
Haynes Stellite Company, Division of United Carbide Corp.	621
International Nickel Co., Inc.	529
Jones & Laughlin Steel Corp.	737
LaSalle Steel Co.	563
Linemaster Switch Company	1145
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Metal & Thermit Corp.	1125
Minnesota Mining & Mfg. Co.	550
Olin Mathieson Chemical Corp., Metals Division	601
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Syntron Company	743
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Welding manufacturers exhibit at Design Engineering Show

DETROIT: Manufacturers seeking ideas for new products or new models of old products will have some 15,000 ideas presented to them at the Design Engineering Show at Cobo Hall, May 22 through 25.

The show is now in its sixth year and is being held in Detroit for the first time. It will present the most recent results produced by the nation's leading research and development laboratories.

More than 400 companies will have exhibits that will cover seven acres and are valued at more than $10-million. Some manufacturers of welding equipment will have exhibits. They are part of a group of welding manufacturers who are becoming more and more aware of the increased interest in one of the important phases of the total welding function: the design of a welded product. Their exhibits will feature and explain welded design. Welding, cutting and brazing equipment, materials, accessories and auxiliary equipment will be shown.

WELDING DESIGN & FABRICATION, which also recognizes the importance of the design function to the continued growth of the welding industry will have a booth at the show. This booth will give WD&F editors a chance to meet and discuss welded design with those in attendance. Currently, 5,000 people responsible for welded design are receiving copies of WD&F.

Thousands of companies will send their designers, engineers, and other executives to see the show. Attendance is expected to exceed 18,000.

As in the past, the machine design division of the American Society of Mechanical Engineers will conduct a 4-day conference, to run concurrently with the show, on the subject of design engineering.

more news on the next page

NEWS BRIEFS

ITS ANNUAL TECHNICAL SALES SEMINAR was conducted earlier this year by All-State Welding Alloys Co., Inc., at its White Plains, N. Y., office. Guest speakers and panelists from customer firms joined with All-State's regional managers for a number of open forum discussion during the four-day meeting.

A CANADIAN AFFILIATE has been formed by Chemclean Products Corp. Chemclean Products of Canada, Ltd. will produce a complete line of industrial cleaners, strippers, and proprietary chemicals for the welding, metal finishing, and plastics industries.

THE ABRASIVE AND GRINDING WHEEL BUSINESS of U. S. Rubber Co. has been acquired by the Manhattan Rubber Division of Raybestos-Manhattan, Inc. Manhattan's abrasive wheel department will now make grinding wheels with the same rubber and resin bond formulas and equipment used by U. S. Rubber Co.

BURDETT OXYGEN COMPANY of Cleveland, the nation's fifth largest producer of industrial gases, has sold the assets of its Santa Fe Springs, Calif., operation to American Cryogenics Co., of Augusta, Ga. Proceeds from the sales will be used in an expansion program in the Midwest area that includes building two new plants for production of industrial gases. These will be in Indianapolis and in either Portsmouth, Ohio, or Wheeling, W. Va.

RADIONICS, INCORPORATED, has announced that its entire line of gamma radiographic equipment will be sold exclusively in the United States and Canada under the Norleco name by Philips Electronic Instruments, a division of Philips Electronic & Pharmaceutical Industries Corp.

National Welding Supply Association meets in New York City on May 8-10

NEW YORK CITY: The National Welding Supply Association will hold its 17th annual convention here at the Hotel Commodore on Monday, Tuesday, and Wednesday, May 8, 9, and 10. The Convention Committee, under the chairmanship of W. R. Flannery, made the arrangements. Other committee members are J. W. Goodliffe, A. B. Scherer, Paul G. Feld, A. C. Axtell, and A. F. Nielsen.

BUSINESS SESSIONS

The stimulating business sessions have been planned. They will feature Dr. G. Herbert True, author and lecturer, who will speak on creativity; Zenn Kaufman, marketing counsel, who will tell how to use showmanship in selling; and The Honorable James B. Utt, United States Congressman from California's 28th District.

The status of the Ohio State Film Project will be reviewed.

Entertainment has been planned for everyone. It begins with the President's Reception honoring President and Mrs. Anderson on Monday evening, May 8th. On Tuesday evening, May 9th, there will be a cocktail party, followed by the Association's annual dinner dance. This will be highlighted by a floor show.

ANDERSON

PROGRAM FOR THE LADIES

A unique program has been planned for the ladies. This includes a special coffee hour on Monday, May 8th, followed by a boat tour around Manhattan Island. A buffet luncheon will be served on board.

On Tuesday, the ladies will be on their own to shop and sight-see. On Wednesday, all ladies are invited to attend the closing business session, to hear speakers, and witness the installation of new officers.

CONTACT BOOTH PROGRAM

On Tuesday afternoon, May 9th, the Association's annual Contact Booth Program will be held from 1:30 to 5:00 PM. So far, 78 companies have reserved space for booths. Again this year door prizes will be awarded to distributors attending the program.

more new on page 81

Ranite HARD SURFACING ELECTRODES

ARE PREFERRED FOR:

FAST DEPOSITION RATE
HIGH RECOVERY OF WELD METAL
ENGINEERED WEAR RESISTANCE

SOLD THROUGH YOUR LOCAL DISTRIBUTOR

RANKIN MANUFACTURING COMPANY
616 SOUTH MARENGO AVENUE • P. O. BOX 631 • ALHAMBRA, CALIFORNIA

For More Information Circle No. 68 on Reader Service Card.

Would you take a chance on a sure thing?

Make your next welder a P&H!

HARNISCHFEGER
Milwaukee 46, Wisconsin

P&H
WELDING PRODUCTS DIVISION

Hackney MILWAUKEE seamless

high-pressure cylinders

Hackney seamless cylinders are formed from a single disc or billet so that the bottom is integral with the cylinder walls. There's little chance for leaks. They are ideal for shipping, storing and dispensing oxygen, argon, nitrogen, hydrogen, carbon dioxide, compressed air and many other compressed gases.

And because all Hackney cylinders are made the cold drawn way, surfaces are smooth inside and out, with crevices, hollows and ridges eliminated. Cleaning and painting time is reduced throughout the life of the cylinder.

Manufactured in strict compliance with specifications which exceed ICC requirements, Hackney cylinders are finished to your order as specified. For complete details, ask for a copy of the new Hackney cylinder catalog. It gives up-to-date information for all your cylinder needs. Write for your free copy today.

Pressed Steel Tank Company

Manufacturer of Hackney Products Since 1902

1473 South 66th Street, Milwaukee 14, Wisconsin

Branch offices in principal cities

Hackney

CONTAINERS AND PRESSURE VESSELS FOR GASES, LIQUIDS AND SOLIDS

For More Information Circle No. 66 on Reader Service Card.

LIBRARY

of welding

Metal Cutting

"The Theory of Metal Cutting," by Paul H. Black, 204-pages, McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York 36, N. Y., $7.50.

This new book is a scientific analysis of the metal cutting processes. It collects and interprets the theories and conclusions concerning what happens at and near the point of a cutting tool. The treatment is fundamental and should help in specifying machining operations and schedules.

The author is presently professor of mechanical engineering at Ohio University.

Weld Metal Tests

"Determination of the Causes of Weld Metal Cracking in High Strength Steels and the Development of Heat Treatable Low Alloy Steel Filler Wires for use with the Inert Gas Shielded Arc Welding Process." H. W. Mishler and others, Battelle Memorial Institute for Wright Air Development Division, U. S. Air Force. May, 1960. 60 pages. Order PB 161 981 from OTS, U. S. Department of Commerce, Washington 25, D. C., $1.50.

This Air Force metallurgical research report describes two low-cost, restrained weld-metal hot-cracking tests that give a quantitative measure of weld metal cracking resistance.

The first test is similar to the standard Lehigh test, except that the degree of restraint on the weld metal increases from low to high as the test weld is deposited. Thus, only one specimen is needed to test a particular filler wire. The design permits the specimen to be fabricated by flame cutting and welding.

The second test employs apparatus that applies an adjustable restraining force to the test weld. The force is applied to the test specimens prior to deposition of the test weld through an air cylinder. A separate specimen is needed for each pressure used.

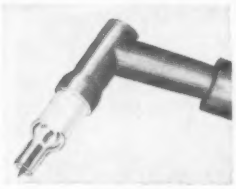
By conducting a series of tests in which the restraining force is increased for each test, a loading pressure is achieved at which hot cracking of the weld metal occurs. This pressure is used as an index of the weld metal's resistance to hot cracking.

continued on page 17

You can LEAN on TEC

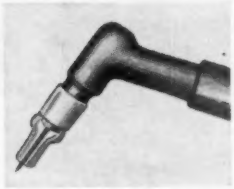
TEC

for the BEST in TIG WELDING PRODUCTS!

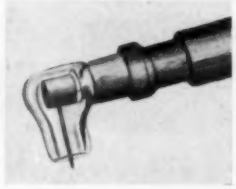


TEC Watercooled Angle Torch

TEC Watercooled Pencil Torch



TEC Aircooled Torch



TEC Offset Chucks & Nozzles

TEC Vycor* Visuweld Nozzles

Hundreds of satisfied users have depended upon TEC to answer their welding problems whether small or complex. TEC is proud of the industry's acceptance and demand for its products . . . delighted with the countless reports of savings amounting to as high as 40% in gas consumption, in inventory, in time and labor. If you are not already enjoying the advantages of TEC TIG welding, then why not "LEAN" on TEC. Contact your nearest TEC distributor or write TEC directly without delay.

BE SURE
To send for the
Free brochure about
TEC'S
NEWEST & TINIEST
TORCH!
You saw it at the
A.W.S. Show

Vycor is a registered trade name of Corning Glass Works, Inc.

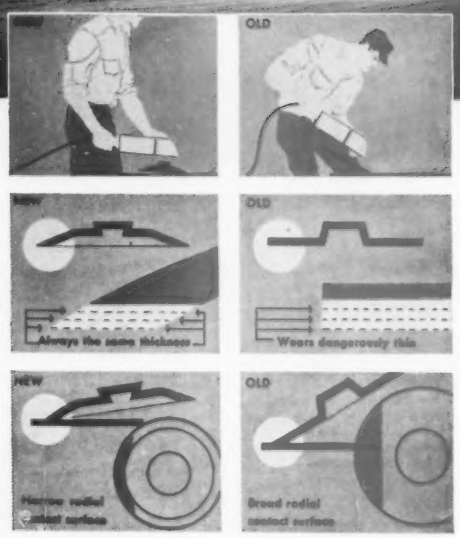
TEC TEC TORCH COMPANY, INC., EAST RUTHERFORD, N. J.
MANUFACTURERS OF VISUWELD EQUIPMENT

SEE OUR SPECIFICATIONS IN VSMF THE MICROFILM CATALOG FILE

For More Information Circle No. 78 on Reader Service Card.

NOW LONGER WHEEL LIFE
with new U-grade "KOOLIE HAT"

Now there are *two* "Koolie Hat" wheel formulations ... the tremendously successful R-grade for standard grinders and standard grinding jobs . . . and the brand new U-grade for up to 30% longer life on all materials. Designed specially for maximum effectiveness on high-speed, air-driven or electric portable grinders that operate at 5200 r. p. m. or more, Bay State's U-grade "Koolie Hat" wheel gives you the same speed, ease of operation and safety as R-grade . . . *plus* longer life on all materials.



◀ *Easier Operation* Koolie Hat wheel is held at 4° to 5° angle instead of 25° to 30°, requires less pressure, virtually eliminates jitter and bounce. Operator's position is much more relaxed.

◀ *Extra Safety* Koolie Hat shape wears evenly over all three abrasive layers instead of one at a time. Less danger of shattering due to heat cracks or thinning of wheel.

◀ *More uniform speed* Narrow radial contact surface between wheel and work keeps speed high for fast, efficient metal removal without heat build-up.

Get full details on the new U-grade "Koolie Hat" wheel from your Bay State distributor or factory representative *now. Better grinding at lower cost . . . that is their business.*

BAY STATE ABRASIVES

Bay State Abrasive Products Co., Westboro, Massachusetts
In Canada: Bay State Abrasive Products Co., (Canada) Ltd., Brantford, Ontario.
Branch Offices: Chicago, Cleveland, Detroit, Los Angeles, Pittsburgh. *Distributors:* All principal cities.

For More Information Circle No. 17 on Reader Service Card.

Metals Handbook

"Metals Handbook," 8th edition, Vol. 1, Properties and Selection of Metals; 8¼- by 10⅞-inches; 1300 pages, 6700 illustrations, 1841 tables, 2806 definitions, data compilations on 456 alloys. American Society of Metals, Novelty, Ohio.

The new ASM Metals Handbook contains more than twice as many pages on the selection and properties of metals as were contained in the 1948 edition. It offers nearly six times as much numerical information (as distinguished from descriptive text) in the form of charts, graphs, and tables. More first-hand examples and comparisons (a total of 1500) are included in the current volume—the first of a series that will ultimately cover all branches of metals engineering and metalworking.

In addition to many highlights, such as articles on selection of steel, other major sections of the book cover carbon and low-alloy steels, cast irons, stainless steels and heat-resisting alloys, tool materials, nonferrous metals, and magnetic, electrical, and other special purpose materials.

Boiler Data

"Boilers: Types, Characteristics, and Functions" by Carl D. Shields, R.P.E. Over 500 illustrations, plus tables and charts, 559 pages, 7⅛- by 10-inches, clothbound, $15.00, F. W. Dodge Corp., 119 West 40th Street, New York City 18, New York.

Covering all practical aspects of the subject, this encylcopedic guide is both detailed and thoroughly understandable. 32 chapters are conveniently organized within 6 major sections: boiler classification, boiler design, steam generating equipment, boiler construction, industry regulation, and industry status.

The author defines those basic industry terms which are often misunderstood and misapplied. He then explains the general classes of boilers. The specific characteristics and function of every important type of boiler—from horizontal return tubular boiler to the hydrogen peroxide generator—is given detailed attention. Boiler design and construction is considered from the point of view of both manufacturer and user; limitations and features of equipment are outlined.

Ampco-Trode 160 reclaimed this 3,000-pound board drop ram.

WHICH OVERLAY ELECTRODE FITS YOUR JOB BEST?

Guide to Ampco-Trode* Characteristics

AMPCO-TRODE 160

DEPOSIT: High strength and good ductility with average hardness of 160 Brinell. Excellent bearing characteristics — resists squashing-out.

APPLICATION: Overlaying bearing surfaces subject to normal wear and shock. Joining aluminum bronzes, ferrous or non-ferrous fabrications, and dissimilar metals.

AMPCO-TRODE 200

DEPOSIT: Average hardness of 200 Brinell. Highest strength-hardness-ductility ratio of the Ampco-Trode series. Excellent wear-resisting characteristics.

APPLICATION: Widely used for bearing overlays where extreme wear and high pressures are encountered.

AMPCO-TRODE 250

DEPOSIT: Higher yield strength and hardness (average 250 Brinell) than Ampco-Trode 200, with lower tensile strength and ductility typical of the aluminum bronzes.

APPLICATION: Extreme bearing applications where very high pressures are encountered operating against hardened steel surfaces.

AMPCO-TRODE 300

DEPOSIT: Highest yield strength and hardness (average 300 Brinell) of the Ampco-Trode series.

APPLICATION: Fabricating new, or rebuilding worn, ferrous dies used for forming or drawing stainless steels and other clean metals. Other severe-wear applications.

*Reg. U. S. Pat. Off.

AMPCO

AMPCO METAL, INC.
MILWAUKEE 1, WISCONSIN
West Coast: Huntington Park, California
Southwest: Garland (Dallas County), Texas

W-148

Bulletin W-17 gives detailed facts on these and other Ampco bronze weldrods. Send for your copy. Tear out coupon and mail today.

AMPCO METAL, INC.
Dept. 176E, Milwaukee 1, Wisconsin

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For More Information Circle No. 10 on Reader Service Card.

ALL THIS and NO EXTRA COST! Why settle for LESS?

Helmet QUALITY is FIBRE-METAL'S Trademark!

OVER 50 YEARS OF WELDING & SAFETY EXPERIENCE!

CHECK ALL THESE FEATURES FOR PROOF!

Check overall... and check detail after detail... and you'll see REAL SUPERIOR QUALITY by any comparison! These features give you *the best... the most for your money!* In value, in comfort, in convenience, in wide versatility of usefulness!

OVERHEAD ADJUSTMENT to raise or lower crown as needed... with 6-position positive lock. Easy to adjust.

NEW RATCHET ADJUSTMENT holds selected size. Designed for gloved hand. Based on Fibre-Metal design used dependably for many years. Widest headsize range!

PLASTIC MATERIAL: a) unaffected by moisture, hence no warping; b) conforms easily to all head shapes; c) easy to keep clean, to sterilize ... unaffected by detergents.

FREE-FLOATING ATTACHMENT permits headgear headband to fit all head shapes perfectly. No side helmet shell pressure on wide heads. No front-to-back pressure on narrow heads. There is no direct connection of headband to helmet shell!

ALL METAL PARTS ALUMINUM for light weight, durability, corrosion resistance (except necessary bronze and cadmium plated steel springs).

WIDE RANGE FRICTION JOINT. Long lasting, holds helmet up easily, needing only slight nod to return to operating position. Easy to adjust.

REPLACEABLE SWEATBANDS (snap buttoned!) of supremely comfortable Genuine Leather (also in simulated leather). Smooth overlap construction, no annoying wrinkles, padded.

4-POSITION HELMET STOP positions helmet for overhead and vertical welding. Easy, positive, no tools required. Allows normal raising of helmet on friction joints.

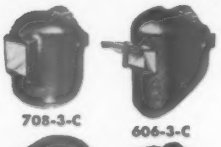
CHIN REST is adjustable to 3 positions ... a real comfort feature, particularly for overhead welding. Also supports helmet shell for longer service life.

THE WELDING HELMET WITH THE WORLD'S MOST COMFORTABLE HEADGEAR!

More than 60 styles of helmets to meet all your needs

QUICK-LOK-equipped Helmet shells are available in all popular styles. Provides quick and easy shell attachment to Safety Caps or the new 3-Q Headgear!

MANY TYPES OF GLASS-HOLDERS, fixed or lift-front, of plastic, steel or Dowmetal. Rugged, light, durable... and insulated from outside to inside. Leakproof to light! All glassholder models replaceable for longer helmet life.



708-3-C 606-3-C

672-3-C 702-3-C

FIBERGLAS* Welding Helmets

FIBERGLAS shells are seamless, completely opaque†, compression molded of Fiberglas-reinforced thermo-setting polyester resin. With strengthening beaded edges, they are rugged, self-extinguishing, impervious to moisture, easily cleaned and sterilized, allow full ventilation.

666-P9 270-3-C 460-3-C

VULCANIZED FIBRE Helmets

Vulcanized Fibre Shells, seamless and fabricated, are LOWER PRICED, light in weight, "sealed" against light leakage, allow full ventilation. Other features as above!

*OWENS-CORNING TRADE MARK

†Even when non-reflective inside coating is scratched!

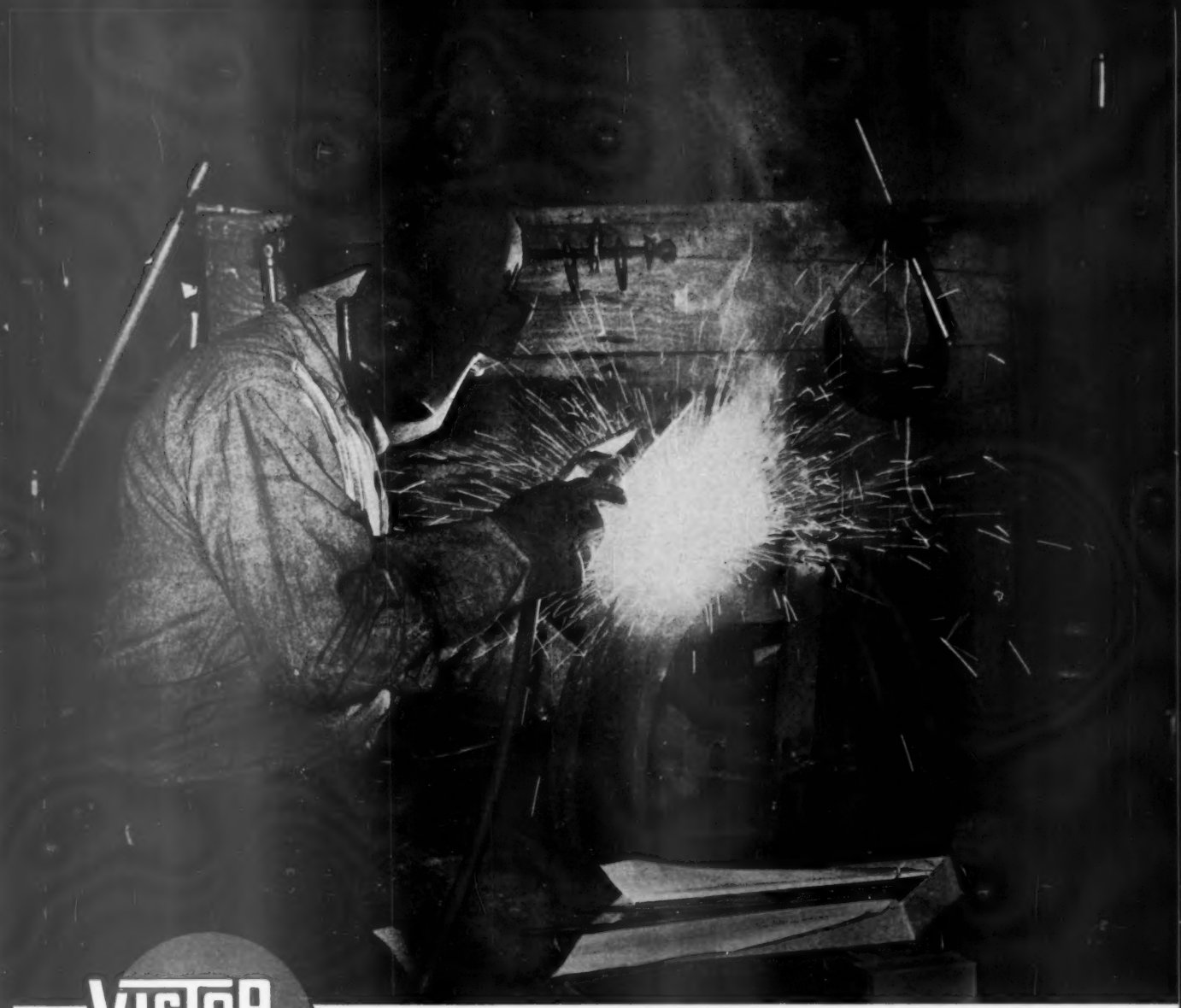
Bulletin No. 73 gives you complete helmet and accessory information.

ASK YOUR WELDING & SAFETY DISTRIBUTOR!

The FIBRE-METAL Products Company | CHESTER PENNA.

In CANADA: Fibre-Metal (Canada) Limited, Toronto

For More Information Circle No. 33 on Reader Service Card.



VICTOR

for hardfacing **NI-MN RODS** *for build-up* *for attachment*

Victor Ni-Manganese for Build-up is 4½% nickel, 13% manganese alloy, specifically developed for rebuilding manganese steel parts such as bucket teeth and lips; rail frogs and switches; crusher, dredge, pulverizer components. May be used as finish build-up or underbase; forms sound, slag-free welds; high deposition rate and good weldability. Deposits are austenitic with full Hadfield steel properties; nonmagnetic, tough and ductile; stands roughest abuse. Made in 5/32", 3/16" and 1/4" diameters; bare, for manual application by DC, reverse polarity.

Victor Ni-Manganese for Attachment welds crack-free, is specially recommended for difficult joining applications on manganese or carbon steel castings, such as: Dipper teeth and lips; track and drive sprockets; dragline pins and links; rail crossovers, switches and frogs; rolling mill parts; crusher screens, hammers, rolls and mantles; dredge parts. Deposited metal is extremely tough, wears well, has high impact strength. It's a wonderful, low-cost substitute for "stainless" where joining rather than corrosion resistance is chief factor. Made in 1/8", 5/32", 3/16" and 1/4" diameters for manual application by AC or DC, reverse polarity.

For all your hardfacing or welding needs, call your Victor dealer. Order Victor Ni-Mn rods today.

Profitable dealerships open; inquire now!

VICTOR EQUIPMENT COMPANY *Alloy Rod & Metal Division* H-65

13808 E. Imperial Highway, Norwalk, California . . . . Wakita, Oklahoma

For More Information Circle No. 81 on Reader Service Card.

wins victory for mines over matter

TIG welding solved a major problem in producing new, lightweight mining hopper cars. And whether you're welding railroad cars, transcontinental pipelines, or nuclear steam-supply valves, Tungsten Inert Gas Welding gives you many outstanding benefits. For the finest there is in Tungsten Electrodes, look to Sylvania.

Sylvania offers the most complete line of top-quality Tungsten Electrodes: Puretung®, Zirtung®, 1% Thoriated, 2% Thoriated. Each comes in the preferred finish—cleaned or ground, and color-coded to save you time and prevent costly errors. Chemical & Metallurgical Division, Sylvania Electric Products Inc., Towanda, Pennsylvania.

There's a Sylvania Tungsten Electrode for every welding need.

SYLVANIA

Subsidiary of **GENERAL TELEPHONE & ELECTRONICS**

For More Information Circle No. 77 on Reader Service Card.

THIS TORCH SAVES MONEY

What an easy way to reduce those high maintenance and repair costs, to eliminate time loss due to damaged torches!

Liquidweld cutting torches are designed to withstand plenty of rugged treatment. But, like any piece of mechanical equipment, they are subject to accidental damage and eventual service wear.

This is where Liquidweld saves you money —because, if damage should occur, you don't need a repair shop.

Should a Liquidweld head seat be damaged, just reach in your Liquidweld do-it-yourself repair kit and select a replaceable mixer sleeve. Drop it in your torch and it's ready to go to work again.

Results: *no repair bills, no excessive loss of use-time!*

For complete information on torches and regulators that are as perfectly balanced as the finest rifles—yet economically priced—send in the coupon for new, complete catalog.

GD GENERAL DYNAMICS CORPORATION | L-C LIQUID CARBONIC DIVISION

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Please send me your new Liquidweld catalog.

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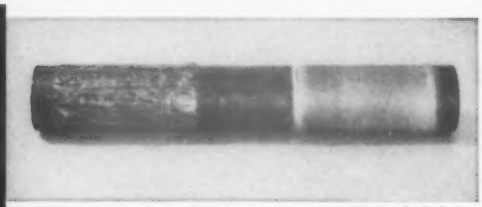
For More Information Circle No. 49 on Reader Service Card.

How flame spraying can pay for itself in your shop in a very short time

ONE EXAMPLE
Hard facing time cut from 4 hours to 25 minutes



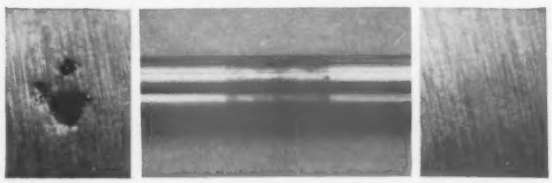
unretouched photo

The two end sections of this shaft have been built up with AMS 4775. Section at left applied by welding – time 4 hours; section at right by flame spraying – time 24 minutes, 45 seconds.

QUESTION: Look at the picture. Which end would you prefer to grind finish?

Here's the whole story. We took a 15" length of 2.5" mild steel shafting and undercut two 5" sections .050" on the radius. We then sent the shaft to a nationally-known job shop with instructions to apply AMS 4775 on the left-hand section, sufficient to finish at 2.5". Weight of welded-on alloy was 17 9/16 ounces – time spent by one of their top men – 4 hours (including preparation).

Then we blasted the second section with steel grit and flame sprayed it with AMS 4775 in powder form (ThermoSpray Powder 15E). The coating was then torch-fused. Weight of deposited alloy – 11 5/16 ounces; surface preparation, set-up and pre-heat – 12 minutes; spray time – 5.5 minutes; fusing time – 7.25 minutes.



Unretouched photo, in center, shows finish-ground shaft. Insets, magnified about 50X, show pits in welded section (left) and no pits in flame sprayed section at right.

We then sent the shaft out to a grinding shop with instructions to clean up at 2.500" plus. The flame-sprayed section cleaned up at 2.510" but welded section still showed pits when grinding was stopped at 2.477" Rockwell of welded end Rc-61, sprayed end Rc-60.

Pump plunger being flame sprayed with METCO ThermoSpray® Powder Gun

These flame-sprayed coatings are solid, homogeneous; usually superior to those applied by other methods. You can apply them at high speed, with lower material and finishing costs. In addition to AMS 4775, a number of other powders – including tungsten carbides – are available for various service requirements; all may be fused–some used as sprayed for certain service requirements.

For further information on this high-speed, money-saving, hard-facing process, phone, write or wire.

METCO INC.
FORMERLY METALLIZING ENGINEERING CO., INC.
Flame Spray Equipment and Supplies

1179 Prospect Ave., Westbury, L. I., N.Y. Telephone: Edgewood 4-1300 Cable: METCO
In Great Britain: METCO., Ltd., Chobham-near-Woking, England

FREE BULLETIN

FREE BULLETIN: Send off the coupon for this and other useful information which shows how flame spraying pays for itself–in a very short time. No obligation, of course.

METCO INC.
1179 Prospect Ave., Westbury, L. I., New York

Please send me information on hard-facing by flame spraying.

Name _____

Title _____

Company _____

Address _____

City _____ Zone _____ State _____

For More Information Circle No. 55 on Reader Service Card.

MEN ON THE MOVE

in the welding industry

PROMOTIONS:

GALBRAITH

DOYLE

John F. Galbraith has been appointed manager of electric welding development and planning, Linde Company, Division of Union Carbide Corp. He is succeeded as manager of the electric welding development laboratory by W. H. Helbrecht.

Howard E. Doyle is regional manager in the North Central States area for Eutectic Welding Alloys Corp., Flushing, New York.

James H. Cupps is sales supervisor, diamond wheels, for the Abrasives Division of the Elgin National Watch Co., Elgin, Ill.

F. N. Zabriskie has been named assistant manager-sales of Air Reduction Sales Company's midwestern region.

Austin F. Leach has been appointed manager for product planning and market research at OMARK Industries, Inc. He had been sales manager for the company's stud welding equipment line.

J. Robert Lowery, formerly a field specialist in Atlanta for Norton Company, has been named sales representative.

The Abrasives Division of Elgin National Watch Company has announced the appointment of **William R. Sundermann,** Philadelphia, as a direct field engineer.

Milton E. Slater is executive assistant to the president at Thor Power Tool Company, Aurora, Ill. He has been with Thor since 1958.

continued on page 24

Boscobel weldor is attaching Jalloy #1 steel wear plates to Bucyrus Erie alloy body and manganese steel lip with Wear-O-Matic WH wire.

35% Savings on bucket maintenance with NEW Wear-O-Matic WH welding wires

"Wear-O-Matic WH is the most versatile welding wire for bucket maintenance because it provides high strength welds in any of the popular alloy steels and has excellent resistance to impact when used for build-up work. Savings in time and labor through the semi-automatic open arc application of this wire have resulted in less bucket down time and lower costs."

L. ARDEN HENLEY, SUPT.
BOSCOBEL GRANITE CORP., MANAKIN, VA.

WHAT about bucket maintenance in your shops? Costs too high due to too many manual welding applications? The important benefit gained by Boscobel Granite was the elimination of manual welding with stainless steel electrodes to obtain the necessary high strength attachment welds for their rugged rock handling chores. These benefits can be yours whether you are welding manganese to manganese, manganese to carbon steel or either of these to any of the abrasion or impact resistance alloy steels. Then, without changing wires, your weldor can apply build-up deposits to lesser worn areas such as latch pins, keepers and lips . . . a deposit that will work harden to outwear manganese steel. To put more service life in the business end of your shovels and drag lines, investigate today the semi-automatic open arc application of Wear-O-Matic WH wires. You'll lower your maintenance costs . . . decrease down time and increase working life. For complete details, request Bulletin AR-21. Alloy Rods Company, P. O. Box 1828, York 1, Pa.

ALLOY RODS COMPANY

YORK, PENNSYLVANIA

SALES OFFICES & WAREHOUSES; BOSTON, NEWARK, PHILADELPHIA, PITTSBURGH, BIRMINGHAM, CHICAGO, SAN FRANCISCO & EL SEGUNDO, CALIF.—DISTRIBUTORS IN ALL OTHER PRINCIPAL CITIES

TWENTY YEARS OF LEADERSHIP IN THE DEVELOPMENT OF QUALITY ALLOY ARC WELDING ELECTRODES

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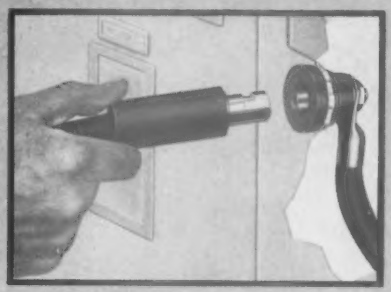
Specify



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POWER CONNECTIONS

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CAM-LOK is standard equipment on various welding machines manufactured by . . .

- Hobart
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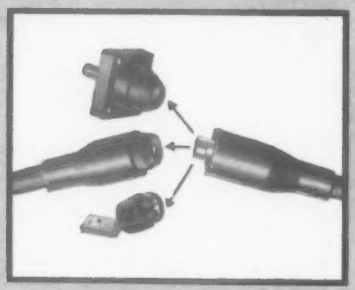
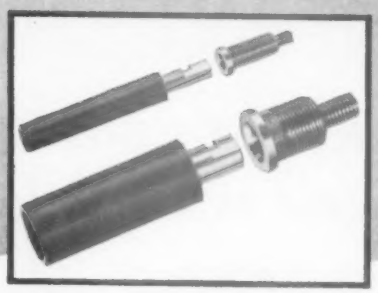
- Forney
- Omark-Graham
- KSM Prods.
- Mid-States
- Bren-Weld
- Birdsell Prods.
- Vacuum Tube Prods.

. . . and many others





Modern power distribution in the welding industry demands a fast, high pressure positive connection with minimum resistance that is rugged, simple and economical. And leading welding machine manufacturers build Cam-Lok connections into their equipment for safe, full power distribution.

Make a better connection now with Cam-Lok, and speed up your production. Write for complete line catalog on plugs, connectors, and receptacles or detail your special requirements.

cam-lok DIVISION
EMPIRE PRODUCTS, INC., 9213-D BLUE ASH RD., CINCINNATI 42, O.
For More Information Circle No. 19 on Reader Service Card.

MEN ON THE MOVE

continued from page 22

PROMOTIONS:

Three executive appointments have been made by **T. Pierre Champion,** president of Champion Rivet Co., Cleveland. They are **E. J. Markert,** vice president of manufacturing; **William F. Dempsey,** Forging Division Manager; and **Donald J. Schaefer,** Welding Division Manager.

APPOINTMENTS:

CONNOR

Miller Electric Mfg. Co., Appleton, Wisconsin, has named **E. W. "Gene" Connor** regional sales manager for eight western states. **D. K. "Don" Rowen** and **A. H. "Turk" Thurlow** will be district sales managers under Connor.

Robert L. Lacy has joined the sales staff of Alloy Rods Company's Hard Surfacing Division. He will cover the midwest out of the company's Chicago sales office. **H. D. Clark** has joined the company's sales force in New England. He will work out of headquarters at Waltham, Mass.

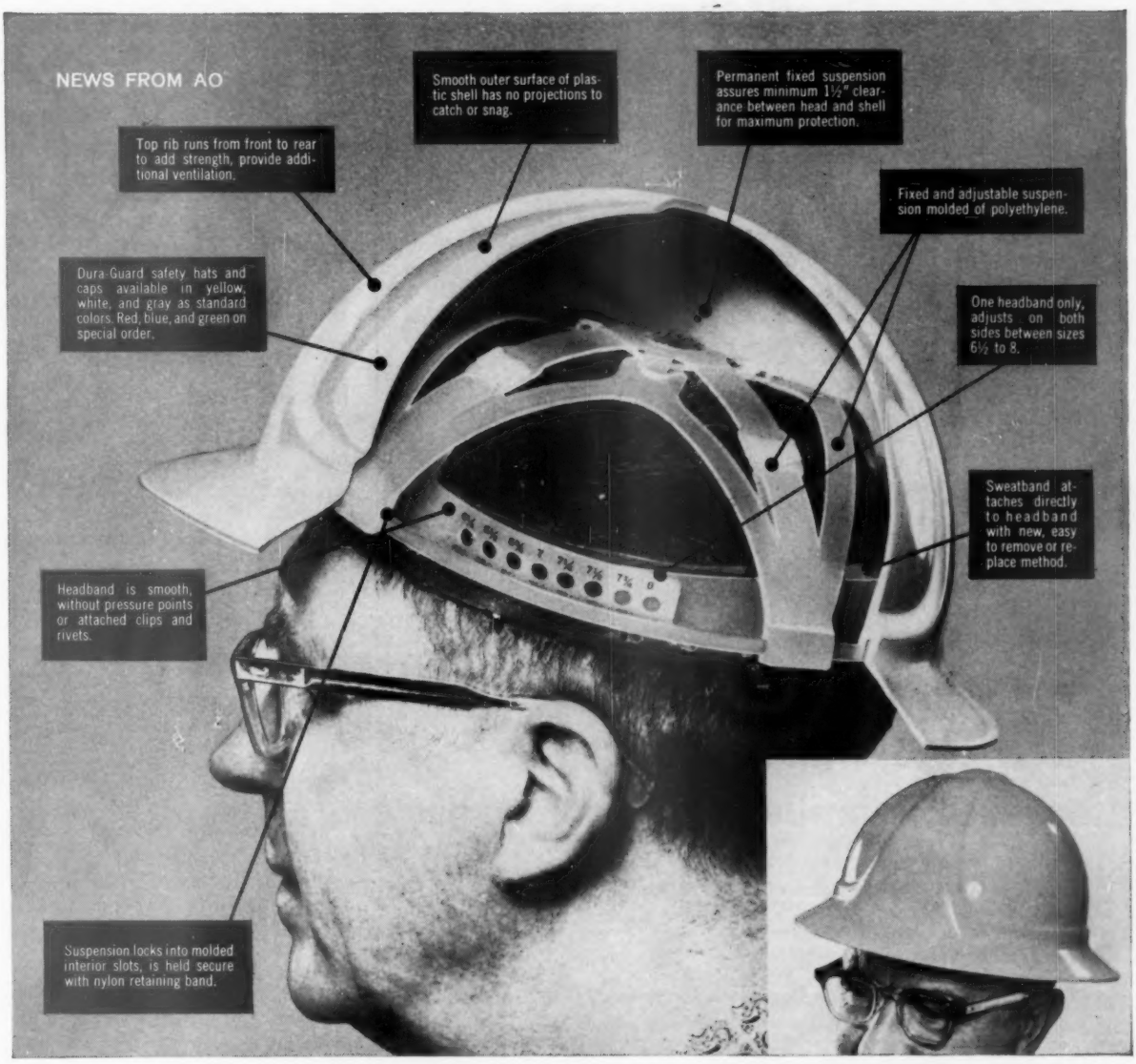
William A. "Scotty" Rendall has joined Monson Welding Sales, Inc., of Syracuse, N. Y. He will be manager of the company's Schenectady branch office.

Samuel R. Evans, field engineer in Lincoln Electric Company's Philadelphia office, has been transferred to Lincoln's Buffalo sales territory.

John E. Taylor, Norton Company sales representative in Toledo, Ohio, has been transferred to a similar post in Cleveland. He is succeeded by **Allan S. White,** formerly a field specialist in Cleveland.

JAWESCO, Inc. has announced the appointment of **Jim Hannon** as sales engineer. The company is a manufacturers representative and is affiliated with Jackson Welding Supply Co., Inc., Rochester.

continued on page 26


NEWS FROM AO
Smooth outer surface of plastic shell has no projections to catch or snag.
Permanent fixed suspension assures minimum 1½" clearance between head and shell for maximum protection.
Top rib runs from front to rear to add strength, provide additional ventilation.
Fixed and adjustable suspension molded of polyethylene.
Dura-Guard safety hats and caps available in yellow, white, and gray as standard colors. Red, blue, and green on special order.
One headband only, adjusts on both sides between sizes 6½ to 8.
Sweatband attaches directly to headband with new, easy to remove or replace method.
Headband is smooth, without pressure points or attached clips and rivets.
Suspension locks into molded interior slots, is held secure with nylon retaining band.

Now: one safety hat to meet all requirements

Introducing the AO Dura-Guard . . . an *all-new* safety hat designed for *universal use*. Shells and suspensions are molded plastic, without holes or metal parts. New Dura-Guard hats and caps meet or exceed all standard specifications, and *every* Dura-Guard may be used wherever dielectric protection is required. Dielectric strength in accordance with E. E. I. specifications (April 1954) is available in individually tested hats and caps.

The injection molded shell is of uniform thickness throughout critical areas. Plastic suspension and headband are lightweight, comfortable, long-wearing, nonconductive, easy to clean. Headband adjusts on *both* sides to stay centered in shell, eliminate floating. Sweatband can easily be slipped out for cleaning *without removing any other part*, is made in telescoping halves for comfort and economy. Front half, which tends to soil or wear first, can be replaced at minimum cost.

For full information, contact your AO Safety Products Representative, or write for Folder S-1456.

Your Surest Protection . . . AO SURE-GUARD Products

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SAFETY PRODUCTS DIVISION • SOUTHBRIDGE, MASSACHUSETTS

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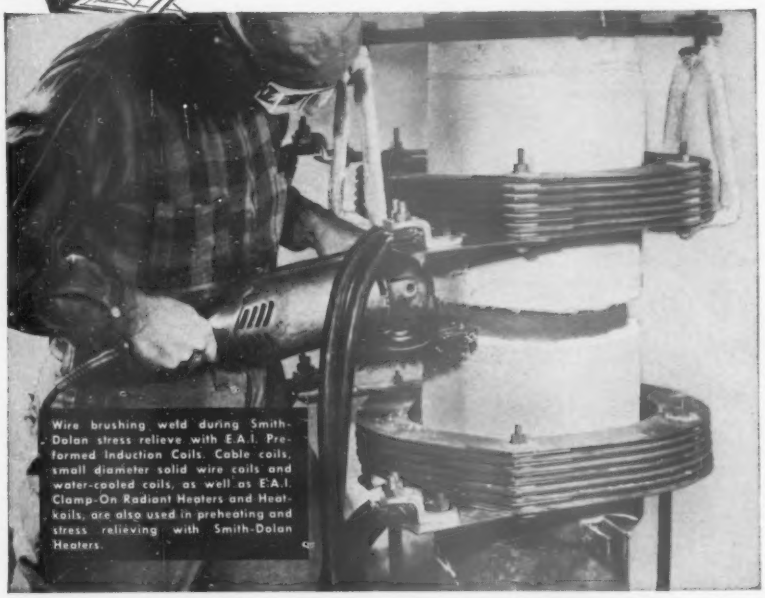
Profit through E.A.I. Research



Wire brushing weld during Smith-Dolan stress relieve with E.A.I. Preformed Induction Coils. Cable coils, small diameter solid wire coils and water-cooled coils, as well as E.A.I. Clamp-On Radiant Heaters and Heat-koils, are also used in preheating and stress relieving with Smith-Dolan Heaters.

For Safety, Simplicity and Efficiency In Stress-Relieving Weldments

use proved Smith-Dolan 60-cycle heating

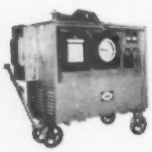
Eliminate Hazards to Personal Safety—No dangerous voltages are involved when using Smith-Dolan 60-Cycle Induction Heaters.

Eliminate Superficial Heating — Gives even, through-and-through heating of wall thicknesses up to four inches and more.

Eliminate High Maintenance Costs—A transformer type machine . . . no rotating parts to wear . . . practically no maintenance needed.

Eliminate Complicated Operation — Self-regulating and voltage stable . . . uses most commonly available commercial voltages . . . on-off operation by inexpensive, durable contactors . . . dual circuit for greater versatility, controlled voltage . . . no technical training needed for expert operation, only a few hours of on-job instruction.

Eliminate Power Losses — 92 to 95% efficient; losses are lowest of all electrical apparatus.



Developed over many years and proved around the world, E.A.I. Smith-Dolan equipment is *designed to meet every stress-relieving requirement with minimum expenditure.* Rental against purchase . . . get first-hand proof in your own plant without capital investment.

Illustrated Brochure on Request

Electric Arc, inc.

152-2 Jelliff Avenue, Newark 8, N. J.

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Representatives in Principal Cities

ELECTRIC-ARC INC.

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MEN ON THE MOVE

continued from page 24

APPOINTMENTS:

James R. Robbins has been named product line manager of electrodes and brazing for the Westing-Arc Department of Westinghouse Electric Corp., Buffalo. He had been sales engineer in Richmond, Va. Prior to joining Westinghouse he was vice president and general manager of Welder's Supply Corp., Richmond.

ELECTIONS:

Herbert E. Brumder was recently elected president of Pressed Steel Tank Company, Milwaukee. He succeeds **Herman Merker** who becomes chairman of the board.

DEATHS:

William Silas Farmer, president of Tolman Mfg. Company, Boston, from 1932 to 1956, died suddenly on March 9th. He was also part owner of Acetylene and Electric Welders Supply Co., Boston.

HONORS:

The Cleveland Section of the American Welding Society dedicated its 22nd annual Welding Symposium held on May 5th to **J. F. "Joe" Wagner,** vice president in charge of production, Burdett Oxygen Co., Cleveland.

CORRECTION:

In March WD&F demoted **J. F. D. Rohrbach,** the president of Raybestos-Manhattan, Inc., Passaic, N. J. We incorrectly said he was the new sales manager for his company's Industrial Rubber and Mechanical Packings Division. The new sales manager is really **R. B. Park**; Mr. Rohrbach is still president.

Welding Problem?

CONSULT YOUR WELDING SUPPLY DISTRIBUTOR

Your welding supply distributor has a wealth of information for you. Let him demonstrate how you can hold trouble free welding in the palm of your hand.

Cool, efficient operation is the key to better profits in the welding industry. Your welding supply distributor will be glad to share his knowledge with you. Why not take a few minutes to talk over your welding troubles with him. He knows your problems and will get you back in trouble free operation in a jiffy.

HI-AMP

354 W. ADAMS ST., JACKSON, MISSOURI

Insist On HI-AMP Accessories From Your Welding Supply Distributor

LENCO, Inc. JACKSON, MO.

For More Information Circle No. 44 on Reader Service Card.

WELDING MANAGEMENT

watches these developments

"ITALY IS NOT MECHANIZED according to U.S. standards," says Ned Hollis. He is doing consulting engineering there. He says, "Labor is cheap ($.65 an hour average) and I haven't seen a single automatic welding head nor anything resembling modern handling equipment as we think of it. One machine builder was even proud of a hand-cranked positioner that made me shudder." Hollis, widely known in the welding industry, is laying out a complete new plant for making oil seals before he returns to this country.

HOLLIS

THE ANTWERP FILM FESTIVAL COMMITTEE presented its highest motion picture honor, the *Diplome De Merite Exceptionnel,* to a Louisville film company, Vogue Film Productions, for the industrial motion picture, "Welding Aluminum—Different, Not Difficult." A separate award was presented to the film's sponsor, Reynolds Metals Co., Richmond, Va.

THERE COULD BE NO PERMANENT GAIN from erecting political trade barriers to keep foreign goods out of this country. That's the opinion of Logan T. Johnston, president of Armco Steel Corp., who says our talent for innovation is the real key to our nation's future.

"When our competitor can provide the same product we are selling today, we must have a new development to offer. And when he matches that one, we must have a third ready for the market," Mr. Johnston said. He pointed out one great natural advantage this country has in meeting foreign competition: "We are here. This gives us a closer relationship and a better understanding of the customer and his requirements."

He concludes, "If we are to preserve jobs and stop "costing" ourselves out of the world markets . . . wage and benefit increases must be justified in terms of productivity."

Olin This new Olin signature replaces the full 12-syllable signature, Olin Mathieson Chemical Corp., and will also be used in all divisional signatures. It features a stylized treatment of the initial letter "O", the top half of which will usually appear in a half tone or color. Purpose of the "O" design is to imply strength and substance and to provide the company with a graphic form which can be used as a separate design element.

REPRESENTATIVES of the eight top railroad car builders in this country have completed a week-long course in advanced aluminum welding principles at the North American research center of Aluminium Limited-Aluminum Laboratories Limited, Kingston, Ontario, Canada. The course included 22 lectures, as well as practical instruction on welding and welded design.

WELDING SUPPLY SALES were up 3-percent for the fourth quarter of 1960 over the same period in 1959. Those are the figures revealed by the National Welding Supply Association. In analyzing sales results from 191 distributor members, NWSA found sales in 1960 were up 4-percent over 1959.

	Acetylene**	Calcium Carbide (short tons)	Oxygen,** high purity	Oxygen, tonnage (short tons)	Nitrogen**	Argon**	Hydrogen**
1960*	12,136	***	55,825	1,478,767	18,115	574	67,474
1959	12,052	1,018,154	45,042	1,398,721	13,699	494	56,938
1958	10,239	902,408	36,088	1,187,837	6,656	378	44,073
1957	10,539	1,016,167	32,886	1,148,807	4,962	397	40,869
1956	9,606	1,024,571	33,268	975,850	4,664	330	38,167
1955	8,512	874,948	29,300	661,575	3,860	247	35,831
1954	6,390	719,304	22,108	463,095	2,373	202	27,759
1953	6,755	793,335	25,300	539,557	2,309	175	25,512
1952	5,978	703,241	22,876	611,835	2,020	—	26,732

*Subject to revision
**Million cu. ft.
***Withheld to prevent disclosure of individual operations

UNITED STATES PRODUCTION of gases and carbide is revealed in figures released by the U. S. Department of Commerce. This report permits a comparison of 1960 production with that of previous years.

Now- all PAGE Welding Wire is COLOR-CODED

PAGE QUALITY PRODUCTS

New System simplifies inventory, cuts scrap loss

AUTOMATIC WELDING WIRE

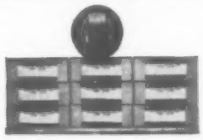
PAGE A-S-16

Customer No. _____ Net Wt. _____

Heat No. _____ Spooler _____

PAGE STEEL & WIRE DIVISION
American Chain & Cable Company, Inc.
MONESSEN, PA., U.S.A.

ACCO



Cartons and spools both have new labels

Both the grade and color-coded stripes are printed on coil liners

New labels are on sides of Payoffpaks and Leverpaks

• For the first time, you can purchase all your automatic welding wire with permanent, color-coded identification. A new labeling system plus specially printed packages helps simplify inventory control, does away with scrap loss due to lack of identification.

Each label, in addition to its color code, shows complete information on grade, size, heat number, weight, and your order number. A typical label for reels is shown above—as the grades of wire change, so do the color combinations. PAGE's new system is the first comprehensive color identification program in the industry.

WRITE US at Monessen, Pa. for new pocket-sized color-code identification card plus new welding wire comparison chart

PAGE WELDING WIRE

ACCO

Page Steel and Wire Division • American Chain & Cable Company, Inc.

Monessen, Pa.*, Atlanta, Chicago*, Denver*, Detroit, Houston*, Los Angeles*
New York, Philadelphia*, Portland, Ore., San Francisco*, Bridgeport, Conn.
*Indicates PAGE warehouse stocks

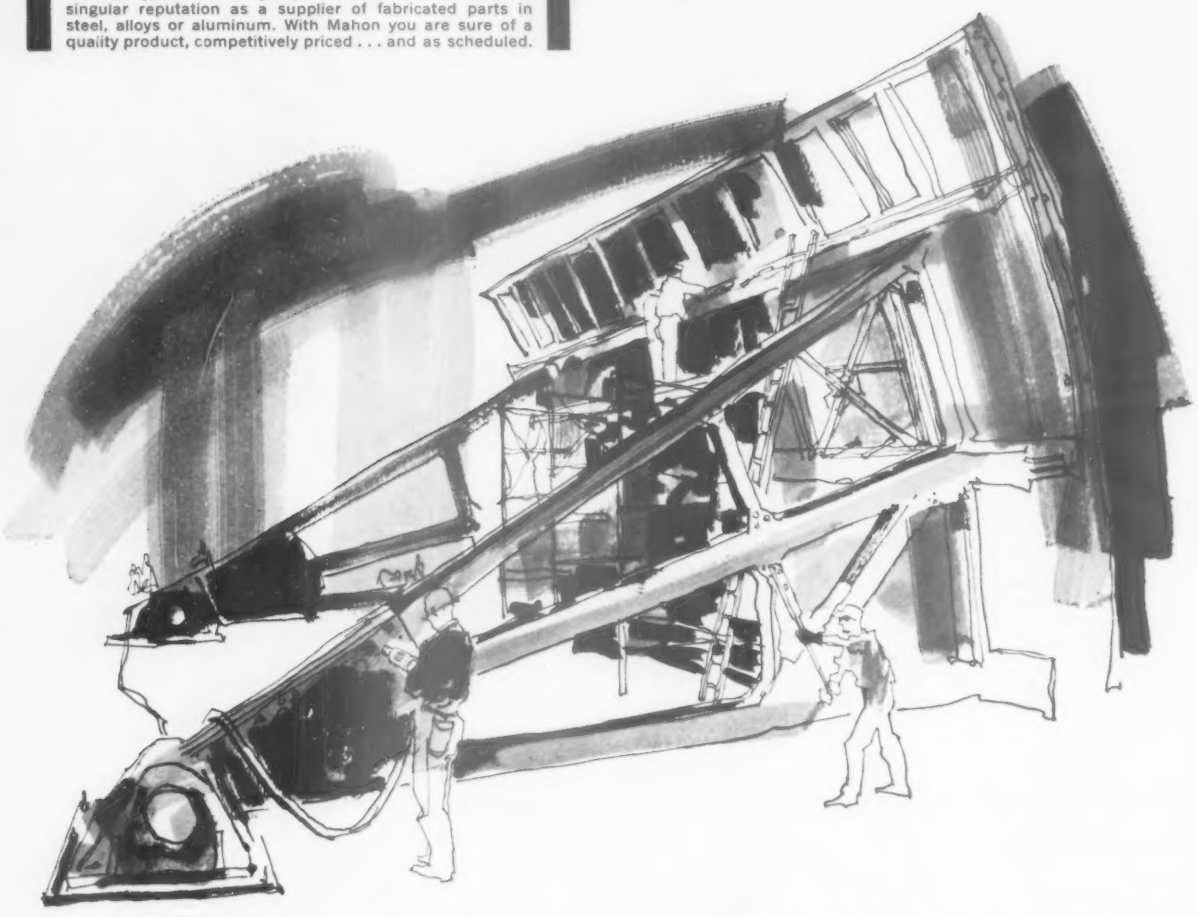
PAGE —*the source for answers to welding problems*

For More Information Circle No. 61 on Reader Service Card.

Old-time craftsmanship backed by extensive modern facilities (as shown in part) is the reason for Mahon's singular reputation as a supplier of fabricated parts in steel, alloys or aluminum. With Mahon you are sure of a quality product, competitively priced . . . and as scheduled.

MEN WHO KNOW FACILITIES, CAPACITY AND **QUALITY**— INSIST ON . . .

"fabrication by Mahon"



When quality and precision comes first—as with this 25 x 35-ft. heavy steel Tainter Gate for a flood-control dam at Waterbury, Vermont—the source should be Mahon . . . where fabrication is an art. Whether your work is mechanical or structural . . . a one-time design or a production run involving welding, machining or assembling . . . Mahon's Steel-Weld Division provides an unbeatable *single-source-service.* And the wealth of Mahon experience is yours to tap at no extra cost. Let us prove why . . . you too . . . should specify "fabrication by Mahon."

THE R. C. MAHON COMPANY • DETROIT 34, MICHIGAN

Manufacturing Plants—Detroit, Michigan and Torrance, California

WRITE TODAY FOR STEEL-WELD LITERATURE . . . OR FOR ON-THE-SPOT HELP DISCUSS YOUR PROBLEM WITH A MAHON FABRICATION ENGINEER.

MAHON

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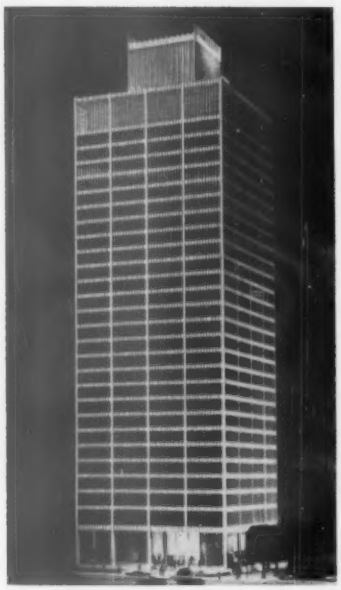
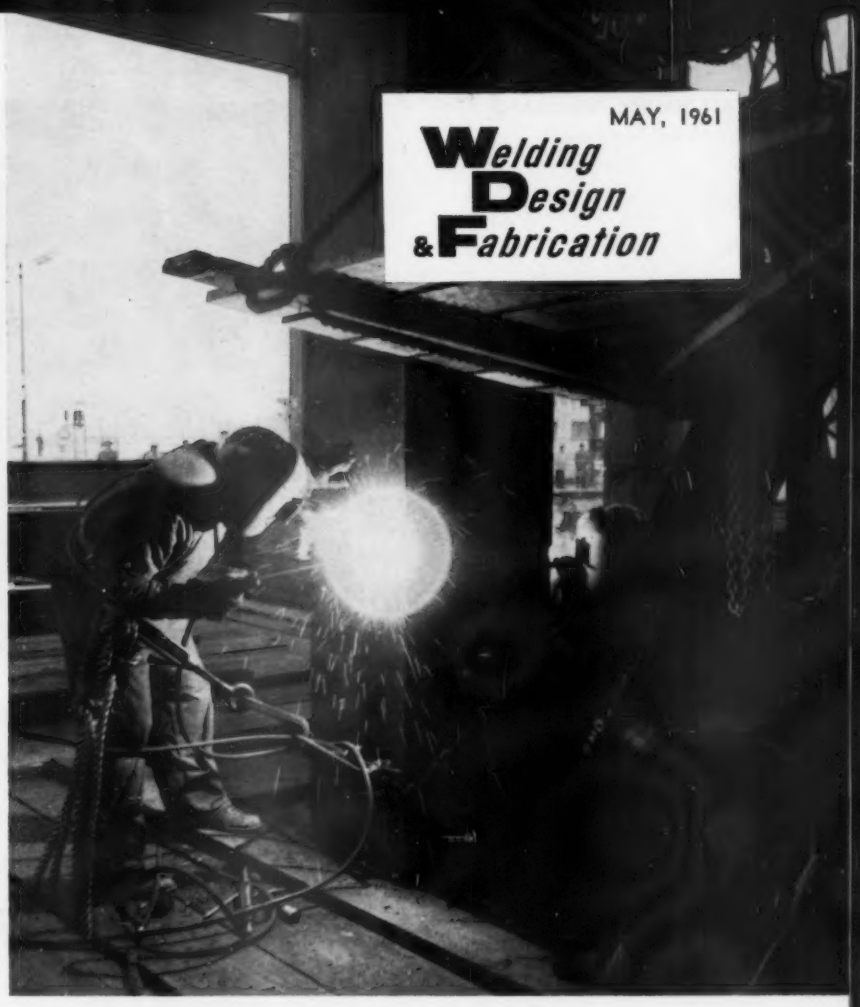
MAY, 1961
Welding Design & Fabrication



it's appropriate that this all-welded building is being built this year in Detroit, the site of the 1961 Design Engineering Conference



Designing the world's tallest all-welded building

by **PETER P. PETKOFF,** *chief structural engineer, Smith, Hinchman & Grylls Associates, Inc., Detroit*

IN BRIEF: The world's tallest all-welded building will have every part of its wind-resisting system welded. In field welding alone, it will contain the equivalent of 40 miles of 5/16-inch fillet welds.

WHAT WE BELIEVE to be the tallest all-welded building in the world is being built in Detroit. The 435-foot Michigan Consolidated Gas Company building will have every part of its wind-resisting system welded. Together with M. Yamasaki Associates of Birmingham, Michigan, our firm designed and is supervising the construction of the building. The structural steel contractor is U. S. Steel's American Bridge Division, which will construct 5,700 tons of steel for the building.

Several things make the welding of this building interesting. We are using "compact" columns made up of thick plates for the lower stories. All beam-to-column and column splice connections are butt welded directly (without any connecting plates or angles). Base plates are butt welded to columns and reinforced with wing plates. Unusual for building work, visual inspection of field welding is aided by radiographic examinations and dry powder magnetic particle inspection. Results of investigations carried out at Lehigh University and published recently by the A.I.S.C. were very influential in the development of connections.

In field welding alone, the building contains the equivalent of 40 miles of 5/16-inch fillet welds.

continued on page 32

continued from page 31

COMPACT COLUMNS made up of thick plates are used for the lower stories and make more usable space available. Fifth interior plate is added where four plates were not enough.

BEAM-TO-COLUMN and column splice connections are butt welded directly without any connecting plates or angles. This type of connection is based on the result of investigations carried out at Lehigh University.

HOW DO YOU DESIGN A WELDED SKYSCRAPER?

The designing architect, Minoru Yamasaki, conceived the new building to suit a number of requirements, tastes, and limitations, namely:

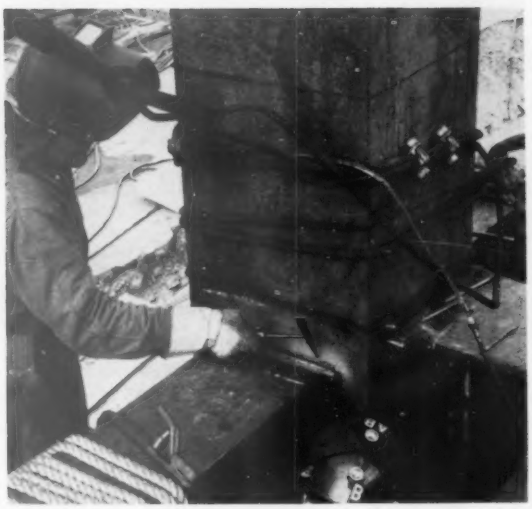
1. Available buildable area.
2. Use for which the building is intended.
3. The amount of floor area needed.
4. The client.
5. Architectural surroundings.

It developed that only a high rise building would answer the problem because the buildable area was small compared to the floor area needed. Models were made of several configurations of high rise buildings, with floor plans for each, along with preliminary structural, mechanical, and electrical engineering. This established the feasibility, economy, and possible choices of materials and systems for the various schemes.

After lengthy conferences, the result was a square building that would contain 16 square bays (30-feet 4-inches on the side) with an area per floor of 15,000 square feet. Four of these bays are for elevators, toilets, and mechanical and electrical equipment. The other 12 bays are offices.

ONLY THREE INTERIOR COLUMNS

Only three interior columns interrupt the office space on any floor. The column spacing is very regular even though somewhat larger than the column spacing for most high rise buildings. All columns are structural steel and are continuous below the 25th floor. Structural steel beams connect all columns at all floors. The beams, the columns, and their lightweight concrete fireproofing make up the wind-resisting frame.



About the building . . .

The new Michigan Consolidated Gas Company building is being built in the center of Detroit's Civic Center on a city block surrounded by Woodward, Jefferson, Griswold, and Larned Streets. It will be set back 70 feet on Woodward to permit widening of the street, and it will be set back 30 feet on Jefferson to conform to a new building line. This area will be used for a reflecting pool.

These set backs reduce the buildable area considerably. Furthermore, Michigan Consolidated required 450,000 square feet of floor area. This led to the design of a square building about 124 feet on the side and rising 28 full stories. On top is a 2-story tower that houses the boiler plant and cooling tower. Both the boiler and airconditioning system operate on natural gas.

Underground there is a basement with a partial mezzanine within the building dimensions, and a 1-story garage under what will be the future widened Woodward Avenue.

The exterior wall of the building a concrete and quartz aggregate. About half of the exterior is glass.

The building is scheduled for completion in November of 1962.

The building foundation consists of belled-out caissons carried down to hardpan. Hardpan is about 115 feet below ground level.

Within each bay the floors are framed with lightweight concrete *waffles*. These *waffles* contain all the light fixtures for a typical floor; the size of the *waffles* was determined by the length of standard fluorescent tube. A luminous ceiling is installed on the bottom of the *waffle* ribs. This is a light aluminum grating that produces a low brightness ceiling. On top of the *waffle* slab, is an additional floor system which is a combination heating and air conditioning system, electrical distribution system, and structural finish floor.

ESTABLISHING THE FLOOR LOADS

Establishing correct useful floor loads is one important phase of structural design of a high rise building. To do this, I spend a week at Michigan Consolidated Gas Company offices scattered in seven different buildings, taking notes, asking questions, examining filing and storage systems, making sketches, and analyzing the information. I found the company kept a tremendous amount of records. This meant their new building had to be designed for higher live loads than the normal office building. We settled on 100 psf for the typical working areas, lower live loads for private offices, and higher live loads for storage and equipment areas.

Choice of wind load was based on requirements of the City of Detroit Building Code.

CHOOSING THE MATERIAL

We had to choose between structural steel or reinforced concrete for the structural frame. Since the building is high, the wind moments are large. Furthermore, our typical span is 30 feet, which is larger than

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ALL-WELDED SKYSCRAPER

continued from page 33

normal. The combined moments at the beam-to-column joints become very high and would be difficult to take care of if we used reinforced concrete. The integrated architectural design of the building prevents the use of columns larger than 2-feet 4-inches square. With presently available concretes it is impossible to design a reinforced concrete column that size and capable of carrying over 6½ million pounds. This is what some of our columns must carry.

WHAT KIND OF CONNECTION?

After we selected structural steel for the building frame, we had to determine the connection to be used. The height of the building and the large spans meant large moments at the connections. To use rivets or high tensile bolts would result in bulky connections.

The building's architecture requires a smooth right angle between the beam and the column. The only way to get this with riveted or bolted connections, and still maintain the required ceiling height for each floor, would be to increase the height of the building by increasing the concrete cover under the beam beyond what is needed for fireproofing. Furthermore, it is practically impossible to fabricate a structural steel column that can carry more than 6½ million pounds and not exceed the 2-feet 4-inches square, including the fire proofing. These considerations reduced our choice of connections to one: Welding.

We are familiar with welding. We used it in the General Motors Technical Center, an all-welded complex of buildings. Of course, this new building was different, because it is so high.

Our solution for the major structural details on this building is, to my knowledge, without precedent. However, judging by the gratifying bids and the manner in which the building is being erected, these details are proving very successful. The steel contractor, American Bridge Division, deserves a major part of the credit for this success.

CHOICE OF MAJOR DETAILS

We specified A284 steel for plates thicker than 4 inches and A373 for structural steel shapes of Group A and for all plates between 1 and 4 inches thick.

The heavy columns for the lower part of the building are made up of four plates welded into a heavy rectangular tube. For some columns, four plates were not enough, so we added a fifth interior plate.

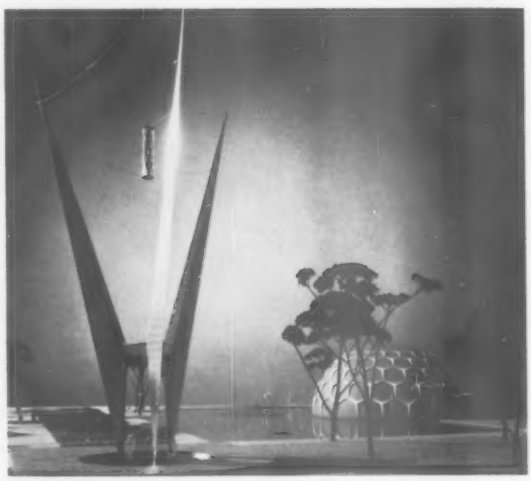
Lighter columns for the upper floors are standard sections. However, all of our beam-to-column connections call for a squarely cut beam and most of them call for a full butt weld across the width of the flanges. This type of connection was tested at Lehigh University. We bolt beam-to-beam connections, bracing, and minor connections.

WIND ANALYSIS

Wind analysis for this building is based on the cantilever method, with modifications as suggested by the late Professor Spurr. Computations were carried out with a computer and checked long hand. • •

How has welded

AMERICAN DESIGNERS were quick to recognize welding as an efficient and economical joining tool, one which gave them great design flexibility. These designers took welding from its infancy in the 1930's to its present position as America's leading metal-joining



STAINLESS CLAD carillon tower will eventually be a part of the Cultural Center at Flint, Michigan.

Welded design

THE INTRODUCTION, development, and acceptance of welding has transformed structural steel from a versatile, but purely structural material, to an architectural finishing material as well.

Bolting and riveting are still perfectly satisfactory for providing a means through which various shapes can be built up, connections can be made, and stresses

ABOUT THE AUTHOR: *Mr. Petkoff received his civil engineering degree at the University of Michigan and his master's degree at the University of Illinois. He joined Smith, Hinchman & Grylls Associates, Inc., in 1948 as a structural design engineer. He is currently an associate of the firm and its chief structural engineer. Mr. Petkoff is a member of the National Society of Professional Engineers, the American Society of Civil Engineers, and the American Concrete Institute.*

design affected American industry?

process. These same designers, who design and redesign more and more products for welding, will carry welding to new and greater heights.

The following statements are from representative parts of American industry. They tell how each has been affected by welded design. It is only appropriate that we start with a statement by Peter P. Petkoff, chief structural engineer, Smith, Hinchman & Grylls, Associates, Inc. He wrote the article about the world's tallest all-welded building starting on page 31.

STRUCTURAL STEEL rigid frame of Cultural Center's Transportation Building will be partially exposed and will be used partly as ductwork for the heating and air conditioning system.

gives architects new freedom

says **PETER P. PETKOFF,** *Smith, Hinchman & Grylls Associates, Inc.*

can be carried from member to member safely. This makes it possible to erect any size or shape of building. But, points and connections made with bolts and/or rivets are rough and bulky, making structural steel generally unacceptable as an architectural finish material.

Welded joints, on the other hand, have all the required structural qualities and can be made leakproof, airtight, and smooth. This makes it possible to achieve new architectural concepts by exposing the structural steel to the eye-and to the atmosphere. An outstanding example is the recently completed General Motors Technical Center near Detroit.

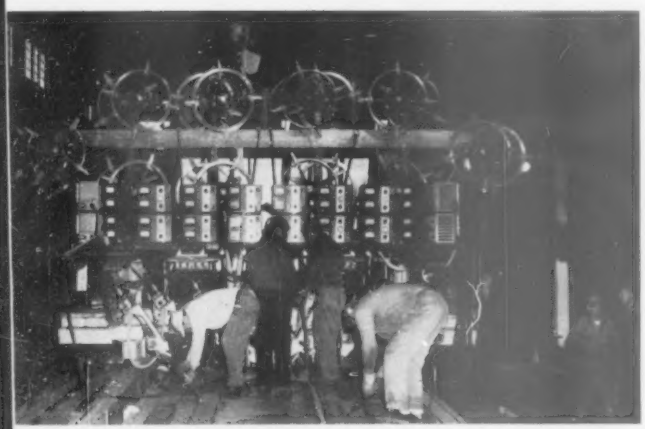
Welding lets the structural engineer join plates, channels, and other structural shapes directly in more advantageous relation to each other. In addition, he can eliminate the supplementary joining plates and angles needed when bolts or rivets are used. This makes it possible to obtain structural elements which are more compact and to eliminate bulky connections. The economies achieved are three fold. First, smaller columns make available more usable plan space. Second, under certain conditions the total framing depth is reduced, making it possible to reduce the height of the building. Third, less material is used for the same structural capacity. These three economies are exemplified by the Michigan Consolidated Gas Company building described on pages 31 to 34.

The use of welding makes it possible to obtain an almost unlimited number of structurally sound architectural forms. This allows the architect to get design concepts previously not practical with structural steel. Some of these new forms are on our drawing boards and are illustrated above. • •

more designers discuss welded design on the next page

Welding permits mass production of freight cars

says W. C. BOESE, *chief welding engineer, Pullman Standard Division of Pullman Incorporated*



THIS 20-HEAD WELDER makes 10 double-head welds at one time. Each weld is 85 feet long. Welder weighs 60,000 pounds.

THIS JIG holds a freight car side in position as two submerged arc heads weld car sides to framing.

WELDED CONSTRUCTION of freight cars is one of the great advances the railroad industry has made since 1946, the end of World War II. One simple fact explains the rapid rise of welding and the ending of riveting: Welding adapts itself more readily to quality controlled mass-production than riveting.

Pullman-Standard has been riveting cars for 50 years. Like other carbuilders, we had long been contract builders. We did a more costly customized job on each lot of cars because each usually had entirely different specifications. It was obviously very expensive to build jigs and fixtures, dies and tools, for just one order of cars. This was almost always the rule until 1946.

Long before this, we realized that mass-production is the most economical way to produce anything, including freight cars. But, it was only our research and development of freight car welding that made standardization and mass-production possible for us.

Our past 15 years experience in building, designing, and servicing freight cars has proved conclusively the superiority of all-welded freight cars over riveted. It has also proved that you can get top economy only with welding.

Of course, when we talk about top economy through welding, we are referring to maximum use of automatic welding. Shown on this page are examples of our automatic welding machines, which use from 2 to 20 welding heads.

An all-welded car has the advantage of lower initial cost. But, there are other advantages: Welding gives greater strength for given weight—a welded car is more integrated than the riveted car. Welding also eliminates many lapped joints where corrosion could occur. This is particularly important in hopper cars where a smooth interior is important.

Relative ease of repair is certainly one of the most important advantages of the welded car. And now that we can weld aluminum automatically, we are no longer limited to the ferrous metals.

We believe that continued concentration on welding education and research will help provide the great American transportation system with products of the highest quality at the lowest cost.

ABOUT THE AUTHOR: *Mr. Boese has always been a keen student of welding design, materials, and procedures. He has worked for Pullman-Standard since* 1911, *watching welding grow from its infancy. As supervisor of welding for all Pullman-Standard plants, he checks on all welding designs, procedures, and equipment. In addition, his laboratory is a constant source of new developments and processes. He has been responsible for the application of high speed automated equipment in frieight car plants. During World War II he supervised the welding of M-4 tank, howitzers, mortars and artillery transport equipment. Each of these involved the welding of alloy steels with special procedures.*

Airframe designers must really understand welding

says **VENE L. DARBY,** *supervisor in the Design Producibility Group, North American Aviation's Los Angeles Division*

WELDING has a multi-fold impact on airframe design. Primarily, basic design concepts must conform to current and newly developed welding processes. The latter differ considerably from current domestic processes. In essence, the designer must develop the assembly as a whole. He must take into consideration the entire sequence of assembly welding and integrate each design element before designing the first weldment. Only by visualizing the design as a properly sequenced weldment, can the designer achieve a successful distortion-free, minimum-weight design.

The airframe designer knows that design changes affect every part of a welded airframe. Changes tend to "snowball" into major redesign if diligence is not taken to keep the overall design in balance—so vital for complex weldments. Heretofore, conventional sheet metal airframe structures were assembled with mechanical fasteners and rivets. It is relatively a simple matter to remove fasteners, replace parts, and add reinforcing doublers for additional strength. Welded designs must be disassembled at specific joints and the rewelding of the replacement element requires a particular sequence of welding to prevent distortion.

Another effect of welding on design is that the metal in and around the weld varies in hardness. Some of the assemblies are heat treated after welding. Consequently the welds approach the parent metal strength. Very large assemblies cannot be heat treated after welding. There is annealed material in the heat-affected zone of the weld point. These annealed joints must be thicker if they are to be strong enough. These hardness levels also must be considered in the structural analyses.

The blend of titanium structure, stainless steel honeycomb sandwich, and various welded inner structure of H-11 and Rene 41 on the B-70, has proven that airframe designers can integrate the various types of weld designs into an efficient, high-strength, minimum-weight airframe.

ABOUT THE AUTHOR: *Vene L. Darby is a 42-year-old native Californian. Born in Northern California, he graduated from high school in 1935, continuing his studies at Yuba College and Modesto College, graduating with a AA degree. He joined North American in 1943 as a draftsman. In 1944 he was named a "B" Design Engineer in the Wing Group. He stayed with the Wing Group until 1955. During that time he rose to "A" Design Engineer and then supervisor. He was named supervisor in the Design Producibility Group. His particular specialty with the group today is the welding of the B-70 Valkyrie triple-sonic bomber.*

Welded highway bridges cost less, look better

says **CRAIG P. HAZELET,** *Hazelet & Erdal, consulting engineers, Louisville*

EXTENSIVE WELDING in highway bridges is fast becoming commonplace. Welding started several years ago with the fabrication of nonstress carrying members. It progressed to welding cover plates onto rolled beams, and to the complete shop fabrication of plate girders. Today, framed trusses for major and long span bridges are completely shop welded.

The material saved by eliminating riveting is obvious. This weight saving is important in long span structures where dead weight is a major part of the stress-producing load.

Bridge engineers accepted welding only after improvements in techniques, equipment, and materials, and the development of basic weldable metals. These, along with complete X-ray examination of butt welds and magnetic particle inspection of fillet welds, insure absolute safety in the finished product.

Steel producers have modified metals to make them easy to weld and eliminate the need for stress relieving them after welding. These metals include A373, A242, A441, and still stronger metals produced today without an ASTM designation. These include steels with 100,000-psi yield strength and 50,000-psi working stresses.

The first major bridge fabricated in this country

continued on page 38

THIS TWIN TIED ARCH double-deck bridge being built over the Ohio River at Louisville is probably the first tied arch involving all-welded shop fabrication. Welding and high strength steels saved an estimated $3/4-million.

was the new Carquinez Straits in California. This was followed by the Benicia-Martinez and Whiskey Creek Bridges, also in California (see WD&F, July, 1960, pages 34-36).

The twin tied arch double-deck bridge being built across the Ohio River at Louisville is probably the first tied arch involving all-welded shop fabrication (see WD&F, March, 1961, pages 30-31 and pages 48-49 of this issue). The entire stability of the spans for this bridge depends on the 800-foot ties. The main stress-carrying elements in these ties are made of T-1 steel, 1 7/16-inch-thick and butt welded 44 times within the 800-foot length.

Welding and high-strength steels saved an estimated $\$3/4$-million in this bridge.

The modern equipment now available in most fabricating shops is making it even more economical to weld better looking bridges of all types and span lengths.

Field welding of bridges now is limited, but it will become more extensive as soon as techniques and controls are improved. At present, major field connections are made with high-strength bolts. • •

Auto industry will do more automatic welding

says CARL W. CENZER, *executive body engineer, American Motors Corp.*

MORE THAN 20 YEARS AGO, American Motors pioneered the design, development, and adoption of the all-welded unitized body for its automobiles. The effort later resulted in the first compact car, the *Rambler*.

Unit body construction is rapidly replacing separate body and frame construction. The automotive industry has recognized and accepted the advantage of integral body and frame construction, such as weight saving, lower cost, rigidity, and elimination of squeaks and rattles.

The combined efforts of the welding engineer, the body designer, and the die designer suited the unitized body to mass production.

New welding equipment and techniques have played one of the primary roles in the development of the unit body.

The first all-steel body used some earlier welding methods but adapted them to the principle of resistance welding. The old forge welding found its counterpart in flash or butt welding. This was used in fabricating large panels from smaller parts. The development of large dies and deep drawing sheet metal eliminated the need for this process.

Arc welding replaced gas welding for use on heavier structural parts.

The practice of clinching two panels together led to the development of the spot welder. This found ready application in spot welding together the two flanges which were formerly used for clinching. This method has influenced body design since 1946. Electronic controls and hydraulic actuation makes possible the great variety of automatic spot welders now in use.

In assembling the unitized body, you have to hold body stampings to close tolerances to assure the high-quality welding required.

There is an increase of 300 percent in the number

9,000 WELDS are used in the single unit body used on all American Motors' Rambler automobiles. Single unit body construction saves weight, increases strength and rigidity.

of welds required in the unitized body over the separate body and frame construction. The welding industry has met this demand by developing time, heat, and pressure controls that produce a fused body of remarkable strength and rigidity.

The unit body eliminates heavy frame sections by using the underbody as part of the basic structure. The underbody components now can be assembled in a hydromatic fixture substantially cutting labor and space.

Spot welding guns have also made possible the uniside method of construction. Roof side rails, pillars, side sills, and rear wheel-houses are all assembled in one fixture on a merry-go-round. This gives uniform door openings and eliminates a large amount of final assembly time.

Each advance in automobile design, welding techniques, and metallurgy is bringing us a little closer to the completely automatically controlled assembly of the entire car body.

ABOUT THE AUTHOR: *Mr. Cenzer has been executive body engineer at American Motors since 1956. A 32-year veteran of the auto industry, he also served as chief engineer in charge of all AM body activities. He was development engineer for Hudson from 1944 until the Nash-Hudson merger in 1954. Cenzer entered the automotive field in 1928 as a chassis-parts draftsman with Dodge Brothers. He later served in body-engineering capacities with Graham-Paige and Willys-Overland. He is a member of the Society of Automotive Engineers, American Society of Body Engineers, and Engineering Society of Detroit.*

Welding is important in structural steel design

says ARSHAM AMIRIKIAN, *special structures consultant, Department of the Navy*

WELDING CAN BE important in structural steel design. It can bring new ideas in structural framing, and save money, materials, and labor at the same time. Yet there is relatively little welded steel construction.

There are several reasons. One is simply prejudice; another is lack of faith in welding and then there are a variety of other reasons. These all can be overcome only by the experience gained through actual use or application of welding. The design engineer needs initative and imagination. The organization needs an open, receptive attitude.

Those who have earnestly explored the full potential of welded design, have found that the results have fully justified the adequacy welding. The experience of the Navy's Bureau of Yards and Docks is a good illustration.

The Bureau first used welding in a major structural framing only in 1938. The first application, however, constituted a complete change in concept and practice, and incorporated a number of design and framing innovations. It was an all-welded framing for a 2-story shop building. Here, for the first time, crane bracket connections were made by welding. For the first time, the butt welds in tension were assigned the same permissible unit design stresses as those carrying compression—a practice which was adopted later by the American Welding Society. The success of this first application encouraged the Navy to extend the use of welded designs in the following years to a wide range of structures. These included the first all-welded floating structures (drydock gate caissons and floating docks) and the first all-welded frames and arches of the widest spans and the greatest heights.

Studies are now under way for the welded design of electronic towers as high as 3,000 feet.

These welded designs saved millions of dollars, thousands of tons of framing materials, and countless hours of construction time.

ABOUT THE AUTHOR: *Mr. Amirikian, D. Sc., is special consultant to the Bureau of Yards & Docks, Department of the Navy. His career has been devoted to developing improved design and analysis methods and developing better construction procedures and techniques. This includes pioneering efforts in the welded design of unusual rigid-frame buildings, large span arch-frame hangars, and huge drydock gates and floating docks. Some of these represent the first and largest all-welded structures of their types. Others are recognized innovations in structural framings. Mr. Amirikian is the author of a design treatise which analyzes rigid frames. He is a member of WD&F's Editorial Advisory Board.*

more design discussions follow

Welded design is key to petroleum refining

says **GEORGE VEST**, *welding engineer, Arthur G. McKee & Company*

WELDING MAKES IT SIMPLER and cheaper to design and build safer petroleum refineries. The methods and electrodes available give the designer a way to make joints that are usually as strong as the base metal, yet saves pounds of expensive materials and hours of labor.

Pressure vessels, tanks, and heat exchanger shells are completely welded. Many of these are too big to ship, are welded into subassemblies, then field assembled, welded, and tested on their foundations. Many large vessels, shipped knocked down, are completely field assembled and field welded.

Welding of piping joints eliminates flanges, bolts, and gaskets, and much accompanying maintenance.

Recent process requirements call for the use of many alloys. These metals were used in a recent refinery project: low chrome-moly; 11-13 percent straight chrome; 18-8 stainless steel, Hastelloy C; and some aluminum. All were butt welded, using either the tungsten inert gas process or a combination of that process (for root passes) and manual metal arc.

High quality weldments of chrome-moly and straight chrome piping requires controlled concurrent heating during welding. This is always difficult and expensive in field refinery construction where many welds are needed. Our company developed a new method of true concurrent heating. We used it recently for the first time on field welding of alloy pipe. The results were excellent. This system automatically controls and maintains concurrent heat on pipe weldments from tack-up to completion. The set range of heating can extend to 600°F. Its use on weldments at any elevation from grade to the top of the highest tower is simple and easy.

Petroleum refineries have to meet codes. Field and shop procedures and operators are qualified in accordance with those codes; records are kept. Radiography, magnetic particle and dye penetrant inspection are used to maintain weld quality.

The application of welding to refinery installations will continue to expand as materials and techniques improve.

ABOUT THE AUTHOR: *G. G. Vest is welding engineer with Arthur G. McKee & Company, Cleveland. His duties include specification and management of welding processes, procedures, and applications, during fabrication and construction of major petroleum, chemical, and steel projects. He has had a wide experience in welded fabrication, construction, and maintenance of dam, petroleum, chemical, and shipbuilding projects. He joined McKee in 1944. Before that he was with Inland Construction Co.; the U. S. Engineers; Chicago Bridge & Iron Co.; and the Bureau of Ships.*

Welded ships benefit builders, owners, operators

says **FRANK L. PAVLIK**, *Sun Shipbuilding and Dry Dock Co., Chester, Pa.*

THE SHIPBUILDING and ship repairing industries have been using welding on a commercial basis for 30 years. The transition from riveted to welded construction was gradual, but this country has led the way. Barges were among the first welded water craft, followed by welded midsections of larger vessels, and finally all-welded ships. Now 1000-foot marine giants are welded.

The elimination of the faying surfaces used in riveted construction permits a substantial savings (15 percent) in steel weight, and lets us use the strength of steel more efficiently. Every ton of weight saved adds that much more cargo-carrying capacity.

The need for a shift of butts to maintain strength in shell and deck plating is unnecessary. The strength of the weld is equal to that of the parent metal.

Stresses in structural members can be transmitted more directly by welding, couples are eliminated and so is the dependence upon shearing and bearing values of rivets.

Proper welding sequence is necessary to avoid locked-in stress. To control quality an X-ray or gamma-

continued on page 45

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FLEETWELD

Several companies make welding electrodes. Many of them are good. But, ask a weldor which one is best for all-position welding, which one welds best on rusty, oily plate, which one delivers best all-around performance. Chances are, he'll say Lincoln Fleetweld 5. Though Fleetweld 5 is the standard of the industry, it's only one of a family of Lincoln electrodes—each one made for a specific mild steel welding task. Read about them all inside.

It is true that Fleetweld 5 is probably the most famous electrode in the welding industry. And for this, we

a really high-speed E6012 electrode, 7MP was intro-duced. Coating has an iron powder content which adds

THESE ARE LINCOLN
FLEETWELD
ELECTRODES ON THE JOB

Customer selected Fleetweld 37 to weld this blower fan housing. Good choice. For, its soft arc and fine ability to weld all position, Fleetweld 37 is widely used on sheet metal work where ease of operation and good appearance are essential. Fleetweld 47 is used in flat or near-flat position.

To get extra tensile strength, Shield-Arc 85 is used on this tubular truss complex. Tube ends chamfered for good metal penetration. Widely used in pressure pipelines and piping due to its high strength. Shield-Arc 85P, similar to 85, makes pinhole-free cover pass welds.

It is true that Fleetweld 5 is probably the most famous electrode in the welding industry. And for this, we are grateful.

But did you know that there are several other Lincoln electrodes—all variations of Fleetweld 5—that have been developed primarily to suit some particular customer need? For instance, when the petroleum industry told us they wanted a smooth-working E6010 rod to give the finest X-ray quality possible on stringer beads, we developed Fleetweld 5P. And for those who use AC machines, we developed Fleetweld 35 which is identical to 5 in every other respect. Fleetweld 180 was expressly developed for AC machines having normally lower open-circuit voltages than industrial machines.

To provide an E7010 version of Fleetweld 5, with proportionately greater tensile strengths, Lincoln engineers came up with Shield-Arc 85. And, Shield-Arc 85P was developed to assure beautiful cover passes without pinholes.

While Fleetweld 5 is the best known E6010 electrode, Fleetweld 7 is the most widely used E6012 electrode for all-position welding. For those customers who wanted a really high-speed E6012 electrode, 7MP was introduced. Coating has an iron powder content which adds to its arc speed and deposition rate.

Some lap and fillet welding is extremely high production work. Here, Fleetweld 72 shines. In fact, all three of these 6012 electrodes—7, 7MP and 72—are excellent for production welding where there is poor fit-up or where work is out-of-position.

Some customers who fabricate much sheet metal work in all positions desired still easier operation and good appearance. For them, we developed Fleetweld 37. And for those who wanted high speeds and deposition rates in flat or near-flat position, there is Fleetweld 47.

So, there they are, the entire Fleetweld family: 5, 5P, 35, 180, Shield-Arc 85 and 85P, Fleetweld 7, 7MP, 72, 37 and 47. Each—born of a specific need—does its job particularly well. Want help selecting the best Fleetweld electrode to suit your problem? See special offer, next page.

LINCOLN ELECTRODES

Here, Fleetweld 7 is used to weld railroad car sections. Picked because of its ability to bridge gaps. Fleetweld 7 and 7MP (a metal-powder rod), are well suited to welding downhill applications, joints with poor fit-up. Perfect for high-speed fillet and lap welding.

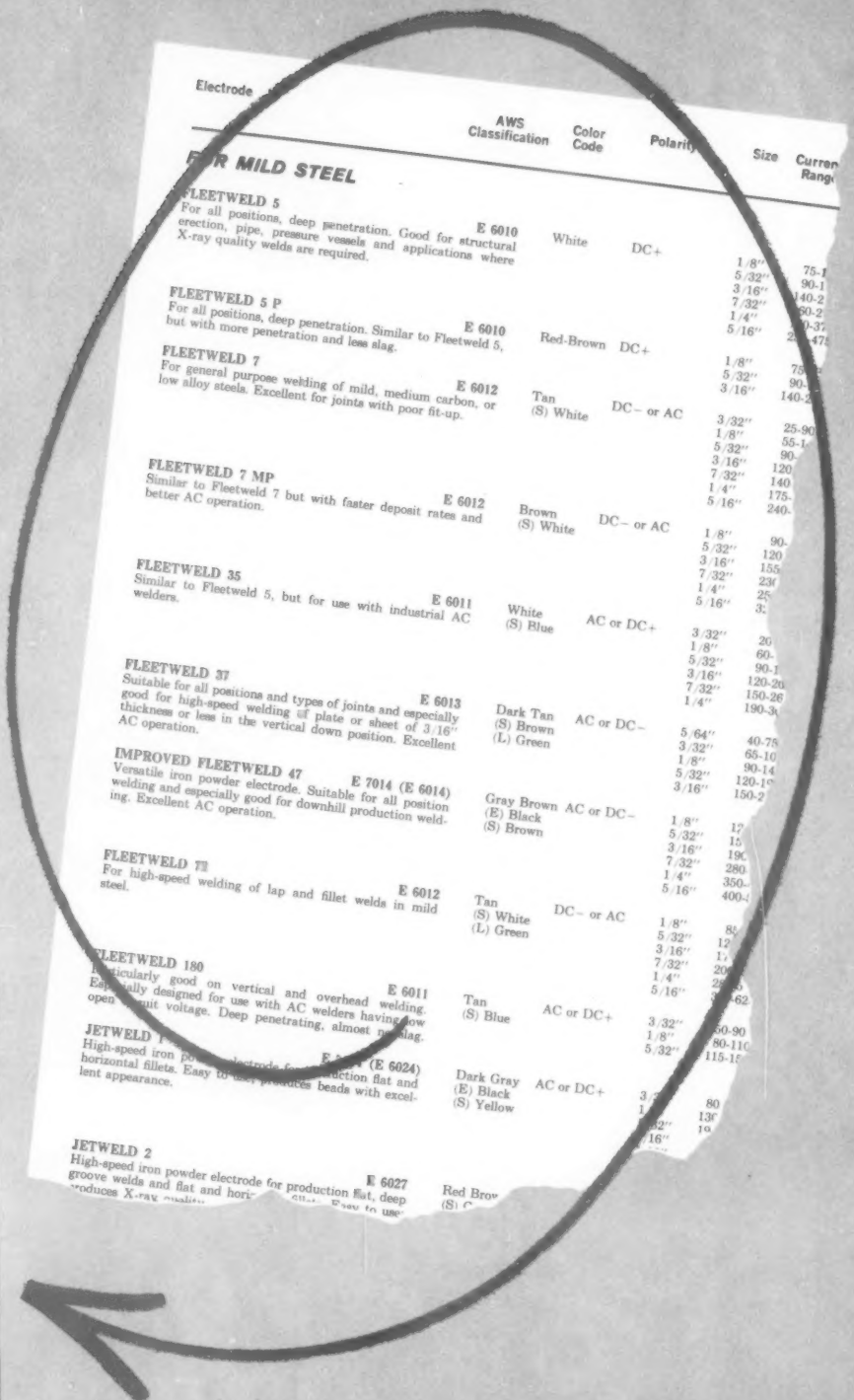
Fleetweld 5 is an industry standard for pipe welding and general maintenance work since it is an all-position electrode. Fleetweld 5P was specially developed to permit smooth pipeline stringer bead welds and deliver X-ray quality superior even to that which you get with Fleetweld 5.

NEW LINCOLN ELECTRODE SELECTION GUIDE AVAILABLE... ABSOLUTELY FREE!

This big, new electrode wall chart lists all Lincoln electrodes made. With it, you can select the exact electrode for your application. What's more, there are columns which list "benchmark" current ranges which will help guide you to the proper setting of your machine for each type of job, each type electrode.

On this chart you'll find sections dealing not only with mild-steel electrodes but hard-to-weld steels, cast iron, low-alloy and high-tensile steel electrodes, etc. In addition to specific electrode recommendations, each is identified by AWS color code markings.

We believe this chart will help you make better electrode selections, save you money. Why not order your copy today? It's free of charge. Write The Lincoln Electric Company, Dept. WW-11, Cleveland 17, Ohio.



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LINCOLN ELECTRODES

WELDED SHIPS *continued from page 40*

ray examination of strength welds is important.

Welded connections require no penetration that can be subject to water or oil leakages. This prevents contaminating cargoes of refined products.

The elimination of the butts and laps in the shell plating presents a smoother surface that offers less resistance to propulsion and saves power and fuel.

Contrast the piecemeal riveted assembly of each part on the shipway to the fabrication of large welded subassemblies in the shop. These are limited in size only by the crane capacities and save many manhours.

Weldments effectively replace large castings. Castings may suffer from porosity, slag or sand inclusion, blow holes, heat checks. The weldments can be designed to avoid stress concentrations, and they can be stress relieved in one operation in a large furnace.

The use of weldments also replace structural sections calling for smithwork and furnacing.

Structural damage is quickly repaired by cropping of damaged members and welding in new steel.

The noise of riveting machines has been cut so the shipyard is a quieter place in which to work. • •

ABOUT THE AUTHOR: *Frank L. Pavlik is chief naval architect at Sun Shipbuilding and Dry Dock Co. He is a professional engineer, a member of the Society of Naval Architects and Marine Engineers, and the Royal Institution of Naval Architects, London. He has had many years of experience in designing and building ships.*

Welded design makes modern boilers possible

says **A. R. MELLINI,** *welding engineer, Quality Control Dept., Babcock & Wilcox Company, Barberton, Ohio*

THE IMPORTANCE of good welded design in making modern boilers cannot be over-emphasized. Customers demand strength and performance at minimum cost. Good welded design is the first step in meeting these requirements.

Before we consider welded design, however, we must first consider the fabricating process. We take into consideration the functional requirements of each component, the different manufacturing processes which can be used, and the conditions under which the finished product must perform.

The most economical design is usually one which requires the fewest welded joints. These joints must be readily accessible.

To lower costs we use sub-assembly production when possible. Sub-assembly requiring control of only one dimension are selected to simplify tooling, to reduce distortion and the amount of straightening and machining. These considerations in turn reduce the problems that might arise in final assembly.

Welded design affects boiler fabrication in several ways. The designer must recognize the type of loads, temperatures, and pressures to which the member or component may be subjected. Welded stresses also have considerable influence on the selection of welding method and application. A power boiler, for instance, may require thousands of pounds of electrodes of varying types and sizes. The choice of electrode type and size will depend primarily on the composition and thickness of the material and the design of the welded joint.

Preheating parts to be welded is an effective way to counteract high stresses in deposited weld metal. Design data, noting the chemical composition and thickness of the material to be welded, will determine the proper preheating temperature. The welding method and type of electrode also influence preheating.

Selecting the welding method is important. Automatic welding is used instead of manual welding wherever possible. However, manual welding must be used for certain points that cannot be welded automatically. Downhand welding is preferred.

Post heat treatment of weldments is again a function of design, the composition and thickness of the material joined, and the complexity of the structure. To avoid cracking in welds in heavy plates, we usually stress relieve the partially welded point. Welded structural components, on the other hand, are rarely heat treated.

We post heat treat welded joints subjected to internal pressure of the boiler. All weldments of chromium-molybdenum steels of low-chromium, air-hardening grades, and most of the high alloy steels are heat treated after welding.

ABOUT THE AUTHOR: *Mellini is a welding engineer in the Quality Control Department for Babcock & Wilcox Co. in Barberton, Ohio. He graduated from Ohio University with a B.S. degree in industrial engineering. After graduation, he worked as a methods welding engineer for Euclid General Motors; as chief estimator and industrial engineer for Cleveland Welding Division of American Machine & Foundry; as welding engineer and manager of technical services for the Metal Products Division of Goodyear Tire & Rubber Co.; and as associate editor for WD&F. He is a member of WD&F's Editorial Advisory Board.*

more design statements follow

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Welded design is ideal for heavy machinery

says **M. J. SHOELSON,** *supervisor, welding engineering, Clearing Div., U. S. Industries, Inc., Chicago*

MUCH HAS BEEN WRITTEN on the advantages of welded structures over cast. Some of these advantages are more pertinent to certain applications than others. At Clearing, we fabricate extremely large and heavy presses. Generally, we make a limited number of units from one design. Welding often is not only better than casting, but actually is the only feasible way to fabricate a large, complicated structure. But, for all structures, the advantages of weldments are many.

Weldments are extremely versatile for low production items. A modified design, similar to an existing one except for a dimensional change, can be reissued to the shop with a minimum of change on the drawings, and without worry about patterns. Modifications can be made during fabricating with a minimum of hardship. This versatility of welded design frees the designer from many limitations.

The savings in fabricating time is a further and perhaps more significant advantage. The normal delivery time of weldments is about one fourth that of castings. A parallel advantage is the definitely lower cost of a weldment. These advantages are extremely important in a competitive market.

Don't overlook the basic improvement in strength and stiffness that welded steel offers over cast iron.

For all these reasons, I say the heavy press industry could not have provided the powerful production tools it has if it were not for welded design.

ABOUT THE AUTHOR: *Mr. Shoelson graduated from Illinois Institute of Technology in 1951 with a B.S. degree in mechanical engineering. He formerly was a research engineer in the Mechanics Department of Armour Research Foundation. Mr. Shoelson is a member of the American Welding Society.*

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Welding revolutionized the design of home appliances

says **RICHARD E. GOULD,**
chief engineer, Frigidaire Division, G.M.C.

ADVANCES IN WELDING are opening up a whole new world of design for the home appliance engineer. The evidence is there in today's variety of sleek appliances.

Refrigerators, food freezers, electric ranges, washers, dryers, dishwashers and built-in appliances reflect new welding techniques and applications. Entire areas of product design have been revolutionized.

For example, consider the advantages of unitized construction made possible by improved welding. Products are better designed, more pleasing to the eye, sturdier, more efficient, and reliable. High-speed, uniform fabrication techniques provide economical construction while maintaining, and even improving, the quality of the product. For the consumer, this means a superior product, a better price.

The 1-piece, wrap-around steel cabinet shell of household refrigerators is a good example of a tremendous advance for the appliance industry. Early models had wood cabinets assembled with screws and glue. The design was cumbersome and the fabrication slow and inefficient. Today's high-speed, high-strength steel assemblies are possible because of developments in resistance welding techniques.

Another revolutionary design step made possible because of gas-tight seam welding was the development of the efficient, hermetically-sealed, internal-drive rotary compressor that powers refrigerators. Compressors used to be of bolted, cast iron construction with noisy, external drive.

Development of gas shielded and copper-to-aluminum welding also improved refrigeration condenser design. Condensers used to be mechanically crimped, furnace brazed fin-and-tube assemblies. Now they are welded plate-and-tube or wire-and-tube construction. They provide better conductivity, more efficiency.

Where do we go from here? Actually, we have scarcely scratched the surface in metallurgical research. As we increase our knowledge of metals, welding will become even better. It follows that newer, broader avenues in design will be opened for the appliance industry.

ABOUT THE AUTHOR: *Mr. Gould received his B.S. degree from the University of Illinois in* 1923 *and an M.S. degree in* 1927. *After working as a designer in Chicago and as a research associate at the University of Illinois, Mr. Gould joined Frigidaire in* 1930 *as an engineer. He held positions as section head, assistant manager of air conditioning engineering department and as supervisor of war products service training. He became chief engineer of the former Aeroproducts Division in* 1945, *and its factory manager in* 1947. *He returned to Frigidaire in* 1953 *as assistant manager of direct factory sales. He became assistant chief engineer in* 1954 *and chief engineer in* 1958. *Mr. Gould is a member of several professional societies, including Sigma Xi, Tau Beta Pi, and the American Ordnance Association.*

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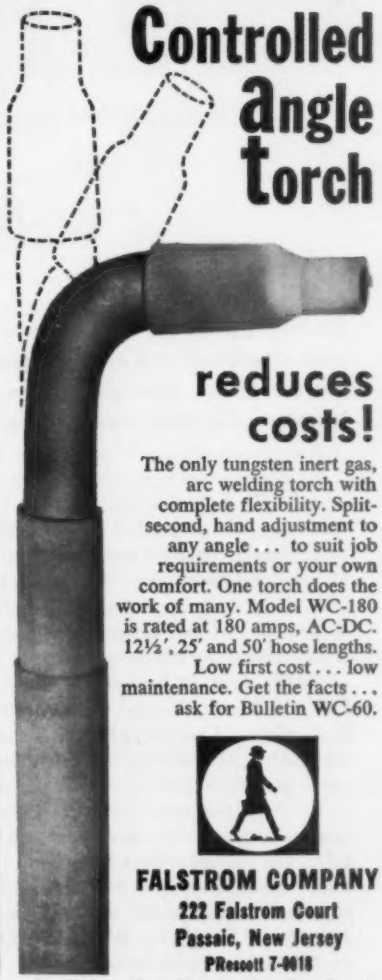

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KEY TO DESIGN of the New Albany double-deck bridge is the application of high-strength alloy steel. The thinner, more compact box sections keep dead load to a minimum.

a welded bridge of heat-treated high-strength constructional alloy steel?

Wanted: Welds with

IN BRIEF: The rules that apply to welding intermediate-strength and mild structural steels go out the window when you build a bridge of heat-treated, extra-strong constructional alloy steel.

NOW IT CAN BE TOLD! Welding details for the unique, double-deck New Albany bridge (covered in our March 1961 issue, page 30) weren't even available til now. Now that they are, we're happy to present the second part of this important article.

The bridge is a tied arch design of two arch spans of 800 ft. each, in tandem. It will span the Ohio River between Louisville and New Albany, Indiana. The R. C. Mahon Company, Detroit, holds the contract for fabricating and erecting both spans and three approach spans of 150 ft. each.

The bridge is unique in two ways. First, the 2-deck design—three traffic lanes on each level—saves over $300,000. Second, about one-third of the bridge (2500 tons) is fabricated of heat-treated high-strength constructional alloy steels (Great Lakes Steel N-A-Xtra 100 and U.S.S. T-1). It's the first arch bridge built of 100,000-psi-yield-strength steel.

In the March article we covered overall design, fabrication, and erection of the superstructure. You'll get more welding facts in this article; facts, we hope, that will help when you build a bridge . . . machine . . . pipeline of this strong, weight-saving weldable steel.

Bridge designers, Hazelet & Erdal, set tough weld standards for Mahon to meet in joining the 100,000-psi-yield steels. The welds had to equal the strength of the plate. Getting this strength meant special welding techniques, electrodes, wires, fluxes; an abrupt departure from the simplicity of welding the other steels that went into the bridge. They are the intermediate-strength A242 steel, and the A-7 and A373 steels. All three weld with the same procedures and the same electrode—E7018.

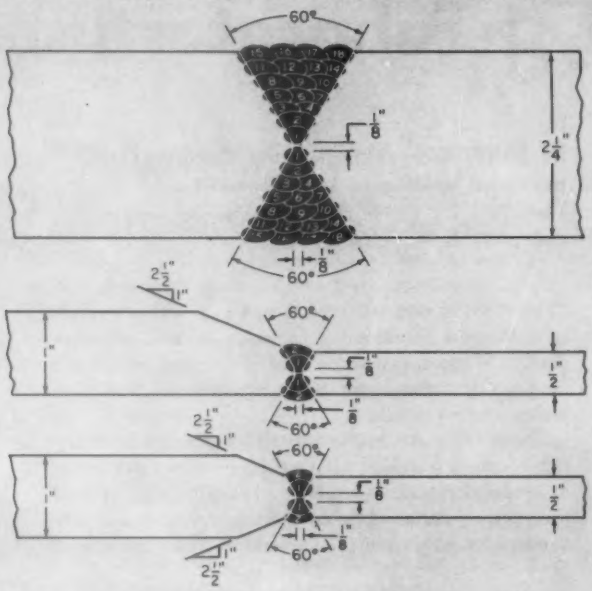
Mahon found that strong joints in the high-strength steel depended on preheating but keeping welding heat low. This is the reason Mahon didn't use tandem submerged arc welding. It uses E11018 low hydrogen electrodes for manual work. And Mahon does considerable hand welding, even on butt joints.

WELD ALLOY IS IN THE FLUX

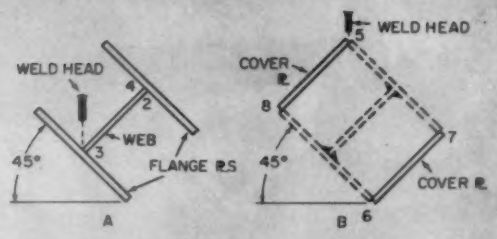
But Mahon does most of the butt welding with hand guided automatic guns, hand welding the root passes.

BUTT WELDS IN HIGH-STRENGTH STEEL

Mechanized submerged arc; root passes-metallic arc



BOX SECTION WELDING ASSEMBLY



A — WEB AND FLANGE PLATES

1 — Insert compressible spacers, fit member, and hold end distance. Roller clamp one end and tack. Clamp and tack the full length with ¼" x 3" fillets on 20-inch centers.

2 — Position assembly to automatically weld the web to the flange. Fillet weld the joint in position #1.

3 — Position to automatically weld fillets #2, #3, and #4 in order.

B — I-SECTION TO COVER PLATES

1 — Machine flame cut cover plate hand holes before fitup.

2 — Fit and tack with 3/16" x 3" fillets on 20-inch centers.

3 — Position assembly and automatically weld fillet #5.

4 — Position and automatically weld fillets #6, #7, and #8 in order.

100,000-psi yield strength

It uses Lincoln Electric Company's alloy flux (A-0905x10) developed for welding the extra-strong bridge steel, and 3/32-inch mild steel wire. The flux alloys the weld to match the plate's strength. Mahon uses 400 amps, 32 volts d.c. straight polarity, welding at 20 ipm. It kept weldment heat below the critical temperature of the heat treated steel.

For the full automatic welding of box-section fillets, Mahon uses their mast-and-boom equipment (they have two) and a standard, mild steel flux. This flux gives strength to spare for fillets that aren't highly stressed. Wire sizes for automatic fillets are 5/32 and 3/16 inch; current, 500 to 700 amps, 28 to 34 volts; and welding speeds, 34 to 60 ipm. They limit interpass temperatures to 350 F in welding ½- and ⅝-inch high-strength plates.

The fundamental structural shape of the New Albany bridge is a box section. Top and bottom truss chords, vertical and diagonal bracing, and the all-important ties are all box sections. Chords and ties are roughly 2-feet wide by 3-feet deep. Ties are fabricated in 72-foot-long sections. Typical plate thickness for chord side plates is 15/16 inch, cover plates, 7/8 inch. Tie side plates are 1 7/16 inches thick, cover plates, 1/2 inch. At the bridge's cable suspension points (there are 16 to a span) tie plates are thicker to compensate for the necessary field connection holes. At these points, side plates are 2 ¼ inches thick, cover plates, ⅝ inch.

AUTOMATIC WELDING IS POSITIONED

The company fabricates chords and ties much alike. Fillets joining box-section members are welded automatically. Top and bottom chords have a full length inside plate (see sketch) at the members centerline. They weld this plate first, cover plates last. Mahon does this so they can weld automatically, and so the completed welds can be magnetic particle inspected. Mahon positions all joints for flat welding.

Ties don't have webs like chords do; instead they have transverse diaphragms every 15 feet. Welding them is more difficult than you'd think. The rule says: Welds are not to be transverse to the stressed member. Since ties are in tension, how do you join them? Mahon decided to use clips, welding these small squares to tie side and cover plates so that the welds run parallel to the direction of stress, not across the lines of stress. Then they weld the diaphragms to the clips.

Mahon's weld inspection is supercritical. Besides magnetic particle inspection of fillets, they radiograph every butt weld. Quality is proved before any structural member becomes part of the bridge. • •

POSITIONING

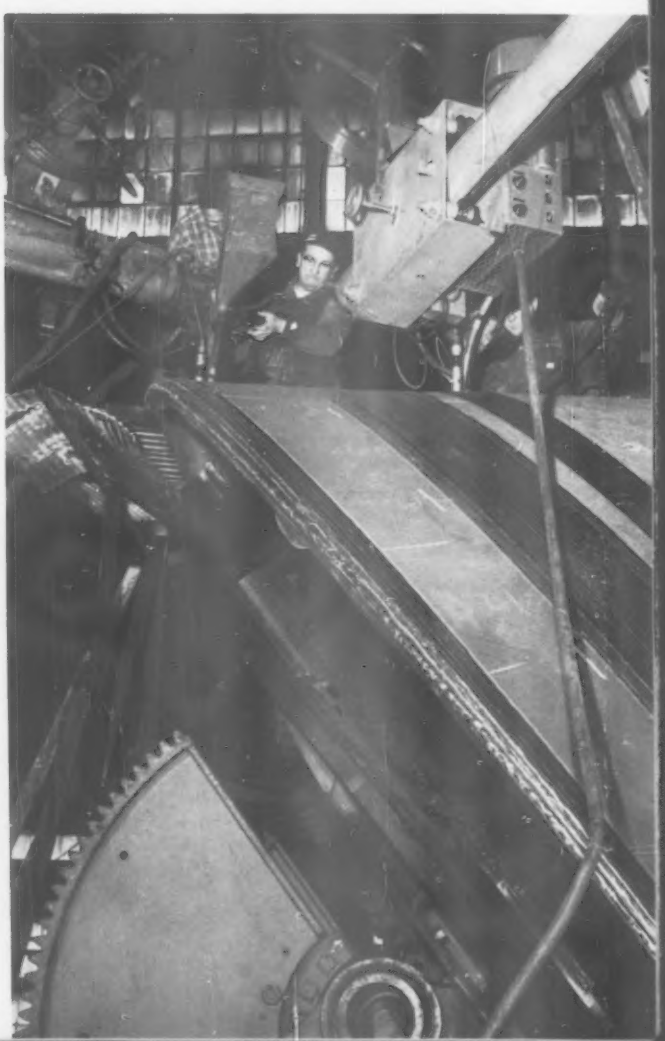
Fabricator uses

IN BRIEF: Morgan Engineering Company uses positioned welding to keep competitive. They find it's faster than unpositioned welding and gives better quality welds.

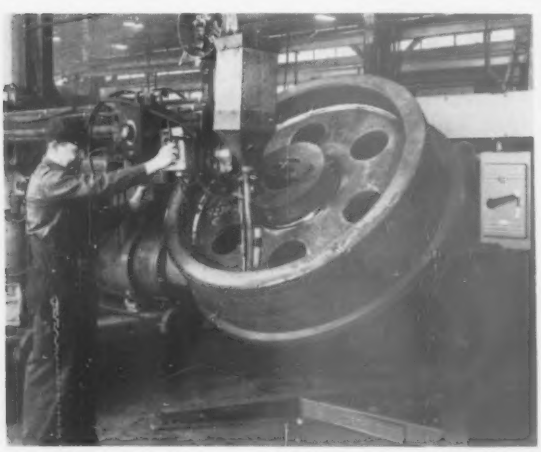
"POSITIONING OUR WELDING keeps us competitive." So said Morgan Engineering Co. to a WD&F editor recently. Morgan explained that positioned welding is up to 35 percent faster than unpositioned and gives better quality welds.

These facts are important to Morgan because they don't have a standard product, hence they can't set up a production line. Morgan makes all sorts of steel mill cranes, automobile presses, complete steam condensers for powerhouses. They do contract fabricating

MANUAL WELDING can be done downhand when a positioner is used. This keeps operator fresh and improves weld quality. Bigger electrodes, higher heats, and fewer passes can be used. Operators (above) are welding soaking pit ram on a 16,000-pound-capacity positioner.



AUTOMATIC WELDING is easier, more accurate when weldments are positioned. Blast furnace bell is surfaced automatically (right) on a 40,000-pound-capacity positioner. Gear blanks (below) are welded in a 3,000-pound-capacity positioner.



positioners, welds 35% faster!

and machining, including work for the government missile program," Luchin explained. They have to bid on every job."

COMPLETE RANGE OF POSITIONING EQUIPMENT

You can tell Morgan is sold on positioning. They have standardized on Ransome positioners. These include:

- One 40,000-pound-capacity positioner with variable speed rotation.
- One 24,000-pound-capacity positioner with constant speed rotation.
- Two 16,000-pound-capacity constant speed positioners.
- Six 10,000-pound-capacity positioners, five with constant speed rotation, one with variable speed.
- Three 6,000-pound-capacity positioners, two with constant speed, one with variable speed.
- One 3,000-pound-capacity variable speed positioner with electronic servo speed control.
- One 1,000-pound-capacity positioner with variable speed.

Morgan also uses five pairs of turning rolls (three with 30-ton-capacity and two with 7½-ton-capacity) and a 16,000-pound-capacity tailstock. They also use five different mast-and-boom welding manipulators in combination with the positioners, turning rolls, and tailstock.

AUTOMATIC WELDING

Morgan really got into positioned welding in 1942 when they started to do a lot of automatic welding. They needed it to get the precise, uniform rotation required for high quality automatic welding with the submerged arc or gas shielded processes. They usually use positioners with variable speed rotation for applications like these:

- Making fillet welds in gear blanks with the submerged arc, joining A7 plate to a SAE 1040 rim in one pass with 5/32-inch diameter wire, 37 volts, and 700 amps DC reverse polarity.
- Surfacing blast furnace bell with fabricated wire and neutral flux. Some bells take as much as 3,000 pounds of surfacing. Surfacing them automatically is many times faster than manual welding.
- Making girth seam weld in ladle crane drum shell. A 5/32-inch wire is used at 31 volts and 650 amps DC reverse polarity to get full penetration weld in 2-inch-thick shell.

MANUAL WELDING

But, Morgan also uses positioners for manual welding. This enables them to weld downhand in awkward places. It keeps the operator fresh, and it improves the weld quality. It enables Morgan to use bigger electrodes, higher heats, and fewer passes. For instance, in making a ½-inch weld on a positioner, Morgan uses a 7/32- or ¼-inch diameter iron powder electrode at 450 amps. It takes two passes to make the weld. Without a positioner they would have to use a 5/32- or 3/16-inch diameter electrode at 390 amps and make the weld in three passes.

A typical job is a soaking pit ram. This is welded in two passes. The first is made with a 3/16-inch-diameter low hydrogen electrode. The finish pass is made with 7/32-inch-diameter iron powder electrode.

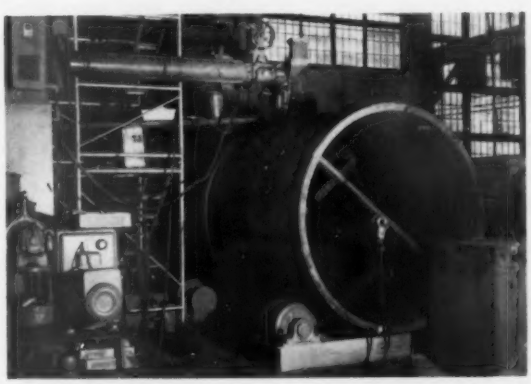
Positioning of manual welding also enables Morgan to weld complicated weldments in proper sequence; this prevents excessive warpage.

Manual welding is usually done on the constant speed positioners. These are rotated to keep different joints in position for downhand welding.

WHAT ABOUT THE FUTURE?

Morgan gave us their ideas on what to look for in the future:

- First, variable speed positioners will practically eliminate constant speed positioners for automatic welding operations. They cost a little more, but they are more versatile.
- Most variable speed positioners will have electronic servo speed controls. These compensate for weight variations in weldments and overcome lag and gravity to give the uniform rotation speed you need for automatic welding. They can also be used for remote control.
- The smaller positioners (with 3,000-pound-capacity or less) will be built with less overall height. This will enable operators to weld while standing on the shop floor, eliminating need for stools or ladders.



TURNING ROLLS are used in automatic welding of a ladle crane drum shell.

Where does your State stand on boiler and pressure vessel laws?

asks **H. W. HEINRICH,** *chairman, Uniform Boiler and Pressure Vessel Laws Society, Inc.*

IN BRIEF: Author explains the need for uniform code laws and how his organization helps law makers enact them and keep them up to date.

STANDARDS AND CODES are important to progress and safety. One of the most important is the ASME Boiler and Pressure Vessel Code. It sets standards for the safe construction of naturally dangerous, but important, vessels you find in nearly all plants, institutions, schools, public buildings, construction projects, or homes. Before the Code there wasn't much assurance that a boiler would operate safe, or long.

There's danger if a vessel containing hot, compressed liquids or gases let's go. And poor design, construction, and maintenance make failure a better than even chance. Even a 30-gallon hot-water tank is a terror if it overheats. The explosion releases 2-million foot-pounds of energy—the same as a pound of nitroglycerine does when it explodes. And think of the energy a 3,000-gallon power boiler holds, with 2,000 pounds pressure at 600°F., it's terrific.

But thanks to the application of the ASME Boiler and Pressure Vessel Code there aren't many boiler explosions any more. The Code has seven active sections:

I. Power Boilers
II. Material Specifications
IV. Lower Pressure Heating Boilers
V. Miniature Boilers
VII. Suggested Rules for Care of Power Boilers
VIII. Unfired Pressure Vessels
IX. Welding Qualifications

The Code is thorough: Sections I, IV, V, and VIII cover the materials, joints, construction, pressures, treatments, and tests for the different vessels. Section II gives complete material specifications for all ferrous and nonferrous metals used in boilers and pressure vessels. They are just about the same as ASTM specs. Section IX gives qualification standards for welding and brazing procedures, machines, and operators.

CODES CHANGE WITH PROGRESS

Technical progress couldn't be made without codes. New materials and new applications, like nuclear energy, compel revisions of the codes and standards to promote safety and economy.

continued on page 54

WHY HAVE UNIFORM BOILER AND PRESSURE VESSEL LAWS?

THIS IS WHAT THEY MEAN

. . . to owners and users: By specifying ASME they are assured of well-built, safe, economical vessels. In a law State, competitors can't cut costs by making inferior vessels. Injury, property damage, and maintenance costs are low.

. . . to manufacturers: They can build to stock, ship vessels anywhere, estimate costs accurately, avoid corner-cutting competition, reduce sales and production costs, and avoid rejections.

. . . insurance companies: When there are fewer explosions insurance companies are able to offer broader coverage at lower premiums. Inspectors qualified by National Board are recognized in all States; and they need know only one code.

. . . to public: Schools, theatres, public buildings, hospitals, plants, and homes are safer.

THE SOCIETY'S OBJECTIVES

- To assist law makers in nonlaw States in the legal adoption of the ASME Boiler and Pressure Vessel Code, its amendments and revisions, and rules and regulations for enforcement.
- To help enforcement agencies amend incomplete and unsatisfactory laws, rules, and regulations.
- To inform members of new and amended laws, rules and regulations. To advise, inform, and help members with laws and rules; to inform members of proper authorities; to issue data on boiler operator licensing; to file and record State laws and regulations.

THESE STATES, TERRITORIES, AND PROVINCES HAVE ADOPTED SECTIONS OF THE BOILER AND PRESSURE VESSEL CODE*

U.S.A.	I Power Boilers	II Material Specs.	IV Low Pressure Boilers	V Miniature Boilers	VII Power Boiler Care	VIII Unfired Pres. Vsls.	IX Welding Qualifications
ALASKA	◆	◆	◆	◆	◆	◆	◆
ARKANSAS	◆	◆	◆	◆	◆	◆	◆
CALIFORNIA	◆	◆	◆	◆	◇	◆	◆
CANAL ZONE (PANAMA)	◆2	◆	◆2	◆2	◆	◆2	◆
CONNECTICUT	◆	◆	◆	◆	◇	X	◆
DELAWARE	◆	◆	◆	◆	◆	◇	◆
DIST. OF COLUMBIA	◆	◆	◆	◆	◆	◆	◆
HAWAII	◆	◆	◆	◆	◆	◇	◆
IDAHO	◆	◆	◆	◆	◆	◆	◆
ILLINOIS	◆	◆	◆	◆	◆	X	◆
INDIANA	◆	◆	◆	◆	◇	◆	◆
IOWA	◆	◆	X	◆	◆	◆4	◆
KANSAS	◆	◆	◇	◆	◆	◆4	◆
LOUISIANA	◆	◆	X	◆	◆	X	◆
MAINE	◆	◆	◆1	◆	◇	◇	◆
MARYLAND	◆	◆	X	◆	◆	X	◆
MASSACHUSETTS	◆	◆	◆2	◆	◇	◆3	◆
MICHIGAN	◆	◆	◆2	◆	◆	◆5	◆
MINNESOTA	◆	◆	◆	◆	◆	◆	◆
MISSISSIPPI	X	◆	X	X	X	◆	◆
NEBRASKA	◆	◆	X	◆	◆	◆4	◆
NEVADA	◆	◆	◆	◆	◆	◆	◆
NEW HAMPSHIRE	◆	◆	◇	◆	◇	X	◇
NEW JERSEY	◆	◆	◆	◆	◆	◆	◆
NEW YORK	◆	◆	X	◆	◇	X	◆
NORTH CAROLINA	◆	◆	◆	◆	◆	◆	◆
NORTH DAKOTA	◆	◆	◆	◆	◆	X	◆
OHIO (S)	O	O	◇	O	◇	O	O
OKLAHOMA	◆	◆	X	◆	◇	X	◆
OREGON	◆	◆	◆	◆	◆	◆	◆
PENNSYLVANIA (S)	◆	◆	◆	◆	◆	◆	◆
PUERTO RICO	◆	◆	◇	◆	◇	◆	◆
RHODE ISLAND	◆	◆	◇	◆	◇	◇	◆
TENNESSEE	◆	◆	◆	◆	◆	◆	◆
TEXAS	◆	◆	◆	◆	◆	◇	◆
UTAH	◆	◆	◆	◆	◆	◆	◆
VERMONT	◆	◆	◆	◆	◆	◆	◆
VIRGINIA	◆	◆	◆	◆	◇	◆	◆
WASHINGTON	◆	◆	◆	◆	◆	◆	◆
WEST VIRGINIA	◆	◆	◇	◆	◆	◇	◆
WISCONSIN	◆	◆	◆	◆	◇	◆	◆
CANADA							
ALBERTA	◆	◆	◆	◆	◆	◆	◆
BRITISH COLUMBIA	◆	◆	◆	◆	◆	◆	◆
MANITOBA	◆	◆	◆	◆	◆	◆	◆
NEW BRUNSWICK	◆	◆	◆	◆	◆	◆	◆
NEWFOUNDLAND AND LABRADOR	◆	◆	◆	◆	◆	◆	◆
NORTHWEST TERRITORY	◆	◆	◆	◆	◆	◆	◆
NOVA SCOTIA	◆	◆	◇	◆	◆	◆	◆
ONTARIO	◆	◆	◆	◆	◆	◆	◆
QUEBEC	◆	◆	◆	◆	◆	◆	◆
SASKATCHEWAN	◆	◆	◆	◆	◇	◆	◆
YUKON TERRITORY	◆	◆	◆	◆	◆	◆	◆

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O Ohio Boiler Laws and Regulations
S Inspectors to hold State commission in addition to National Board

THESE TWELVE STATES ARE STILL WITHOUT ASME BASED LAWS*

ALABAMA
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MISSOURI
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NEW MEXICO
SOUTH CAROLINA
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Straight line cutting	65"	89"
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UNIFORM CODES AND LAWS

continued from page 52

Unfired pressure vessels, the kind that don't get outside heat, are used more and more. The chemicals, plastics, petroleum, and other industries, require them. Once almost ignored, these vessels now get top attention.

CHAOS BEFORE ASME CODES

Before the birth of the ASME Code, States and cities passed laws regulating the construction, installation, and inspection of steam boilers. No two laws were alike, and because they weren't a vessel acceptable in one State could not be shipped to another. Buyers, with plants in several States, were in a fix too. Inspectors qualified in one State couldn't practice in another. There was only shaky confidence in safety factors, materials, and parts because the requirements were different everywhere. Imagine the costly confusion.

The code was certainly needed. But a code isn't much use unless it's compulsory. The Uniform Boiler and Pressure Vessel Laws Society, Inc. was founded to do this job.

WHAT IS UBPVLS?

UBPVLS is a nonprofit, noncommercial association of manufacturers, casualty insurance companies, owners and users. It is dedicated to enacting safe boiler and pressure vessel construction laws, and to keeping

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them on the books. It helps law makers get the ASME Code adopted; it promotes uniformity in inspection rules and regulations wherever sections of the Code have been adopted.

The Society cooperates with the National Board of Boiler and Pressure Vessel Inspectors and others that enforce the laws.

HIGHER STRESSES THAN BEFORE

Although boilers and pressure vessels have higher stresses than ever before, there's little cause for alarm. Thirty-eight States and all but one Canadian Province have adopted sections of the Code. The job is far from done. Twelve States do not have Code laws, and in some States that do, political maneuvering threatens the effectiveness of the laws.

HOW TO MAKE CODE COMPULSORY

Suppose you live in a nonlaw State; how can UBPVLS help you put a boiler and pressure vessel law on the books? The best way to find out is to write us at 95 Liberty Street, New York 6, N. Y. We *can* help. For example: In a nonlaw Southern State, politics had shut the door on a Code law, even though it was highly favored by all who knew the need. Supports, led by an engineering professor, dug in, and we helped them draft and implement a safe construction bill. It passed. • •

H. W. HEINRICH, chairman of the Uniform Boiler and Pressure Vessel Laws Society, Inc., has a lot to do. He drafts and reviews laws and amendments, issues bulletins, keeps track of people, does a hundred other things to promote uniform and effective code laws. He travels extensively: attends hearings, visits law makers and inspectors, and appears before conferences and technical groups to publicize the Society.

Mr. Heinrich is a native of Vermont. He served in both World Wars; in the first as a naval officer, in the second in top government safety posts. He is a member of numerous civic, safety, and technical societies, and has been honored, here and abroad, for his safety work.

Heinrich is a registered engineer (Connecticut), and an authorized Boiler and Elevator Inspector in several States. He has written several books and numerous magazine articles.

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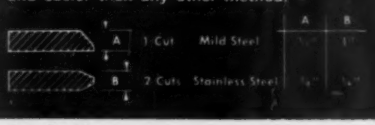

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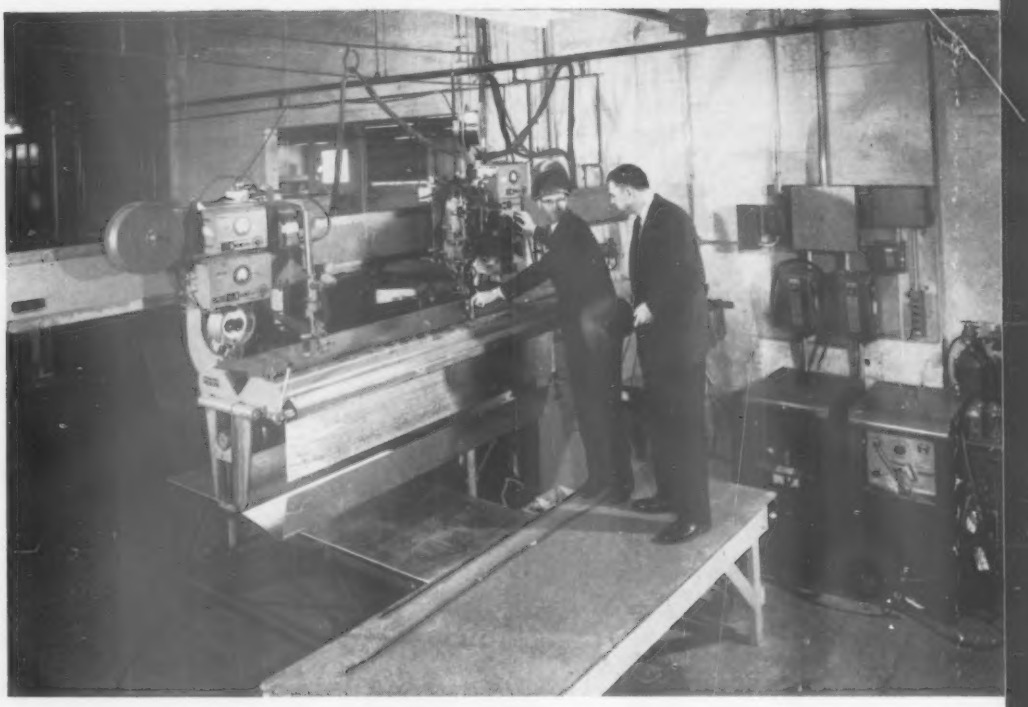

AL EARLBECK (left) explains automatic welding set-up to Editor Chuck Berka of Welding Design & Fabrication.

Automatic welding solves 5 problems

IN BRIEF: A welding supply distributor works with a customer to improve welding quality and increase production of duct work for heating and air conditioning.

A WELDING SUPPLY DISTRIBUTOR must often help his customers solve difficult welding problems. Such was the case when Al Earlbeck of Earlbeck Welding Supplies, Inc., worked with Lloyd E. Mitchell, one of Baltimore's oldest and largest mechanical contractors. Mitchell makes duct work for high velocity heating and air conditioning. They make it from galvanized and hot rolled steel, stainless, copper, aluminum, monel.

THE PROBLEM

Herb LeVee, Mitchell's sheet metal superintendent, told Earlbeck that his company couldn't make the duct work fast enough. He also went on to explain that welding quality was unsatisfactory. He gave an example. Mitchell had been welding 16 page galvanized duct work manually with a carbon arc and a copper-silicon filler rod. Here's what was wrong:

1. Pieces had to be hand fitted and tacked every 3 or 4 inches.
2. Welding was slow, about 4 ipm.
3. Heat build-up caused distortion.
4. Welds were rough, penetration uneven, and there was too much spatter.
5. On galvanized material the welding burned off ¼ inch of zinc on either side of the weld.

THE SOLUTION

Earlback recommended an automatic butt welding setup to which Mitchell added self-centering and other refinements. This permits Mitchell to do these things.

1. Weld faster; 15 times faster on the 16-gage galvanized steel.
2. Eliminate tacking; a special clamping fixture with a series of copper holddown bars butts sheet edges and holds them in place for welding. This upsets them slightly and compensates for any inaccuracies in the edges.
3. Eliminate distortion; the copper holddown bars and a copper back-up bar shunt heat away from the welded points.
4. Improve welding quality and appearance, and eliminate spatter.
5. Burn-off practially no zinc when welding galvanized.
6. Do away with electrode stub loss.

THE EQUIPMENT

The automatic welding equipment (a longitudinal butt and corner welder) has two interchangeable heads. One head is used for automatic gas shielded welding with a consumable electrode on mild steel and galvanized, and on stainless and aluminum (over 0.090). The other head is used for tungsten arc welding. Filler metal is added on aluminum (under 0.090), copper, and Monel. No filler metal is added on stainless (under 0.090) and aluminum (under 0.060).

The machine welds duct work from 0.010 to 0.250 inches. It is mounted on a special platform to accommodate work with a maximum diameter of 60 inches (minimum diameter is 8 inches). • •

It's easy on the welder
It's flexible . . it's tough

Yes, Belden Welding Cable is "easy on the welder." It's engineered and manufactured to be extremely pliable, limp and flexible. Result: more production . . better quality . . lower costs.

And Belden Welding Cable is rugged . . rough and ready for the most severe conditions of abrasion, impact, as well as exposure to heat, cold, and oil.

Belden has a welding cable engineered for every possible welding requirement . . Oil Tempered Rubber Jacketed . . Neoprene Jacketed . . HVF Vinyl Plastic Jacketed . . Whip Lead, Super-flexible and Neoprene Jacketed . . Neocote colors for identification . . Rubber Jacketed Welder Supply Cords.

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Belden Welding Cable comes in many ready-to-use package lengths.

Welding Cable by Belden

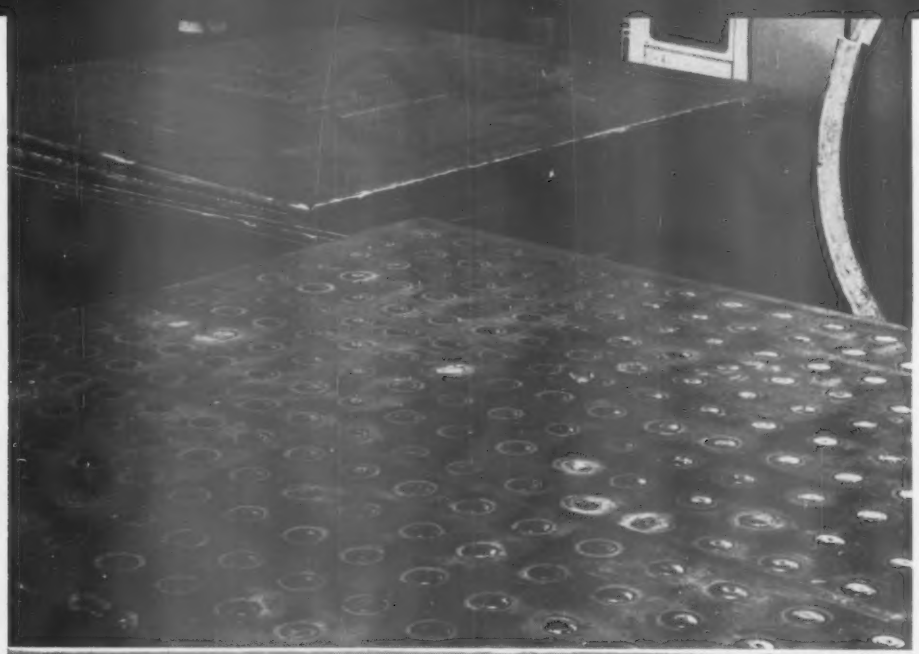
WIREMAKER FOR INDUSTRY
SINCE 1902
CHICAGO

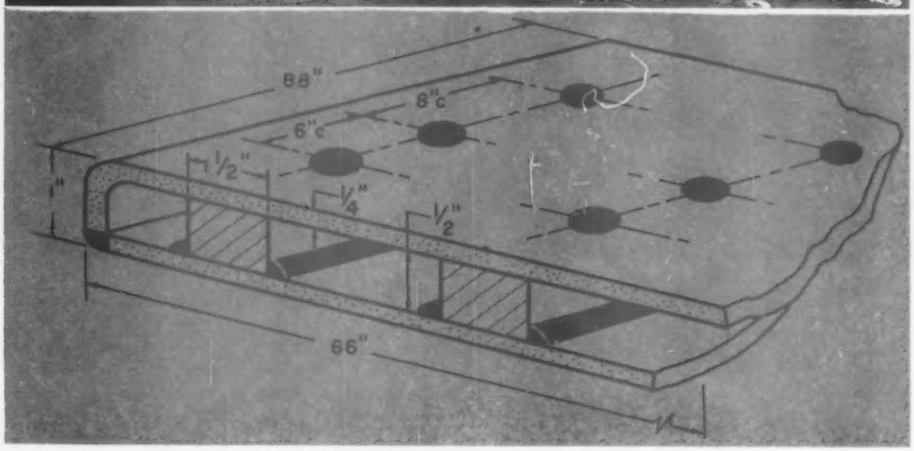
one wire source for everything electrical and electronic

magnet wire • lead wire • power supply cords • cord sets • portable cordage • electronic wire • control cables • automotive replacement wire and cable • aircraft wire

18-1-0

redesign for semi automatic welding cuts costs, increases quality





CO_2 plug welding is 95 percent faster

by **MICHAEL BENDER**, *chief metallurgist, Buflovak Equipment Division, Blaw-Knox Company, Buffalo*

IN BRIEF: Plug welding with coated electrodes used to take 78 seconds per weld. It's now done in four seconds, using semi-automatic CO_2 welding with a flux-cored electrode.

DEPENDABLE PLUG WELDING! We needed it in making shelves for vacuum dryers. These shelves are steel, have anywhere from 117 to 336 plug welds. The welds must be leakproof to hold the 360°F steam that passes through the shelves.

WHAT WAS WRONG

It used to take us 78 seconds to make a plug weld, most of that time going in removing slag. We welded with 3/16-inch E7018 electrodes at 230 amp, d.c. reverse polarity.

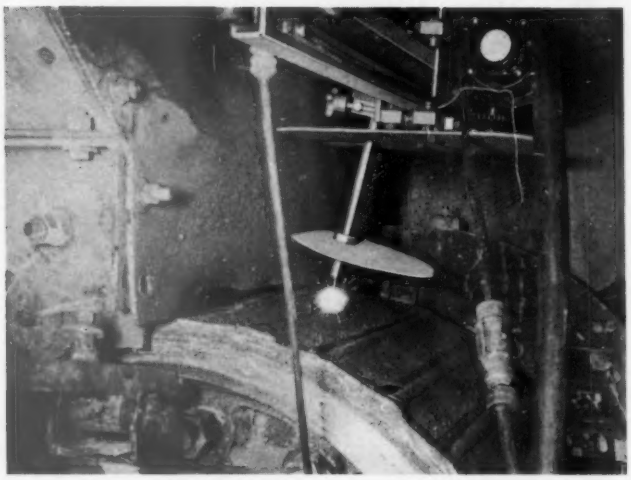
Before welding, we laboriously drilled 1-inch-diameter holes. These gave us the welding room we needed to get good fusion at the root. Even then, weld quality was not as consistent as we would have liked.

THE CURE

We cut welding time 94 percent by switching to semi-automatic CO_2 welding with a flux-cored electrode. Now it takes us only four seconds per plug, mainly because we have no slag to clean. We weld at 420 amps, d.c. reverse polarity, using a 3/32-inch electrode.

The smaller electrode doesn't need a 1-inch hole. Now we get by with a $\frac{5}{8}$ inch hole. We have better access to weld roots so welding quality is more consistent. And, we punch the holes instead of drilling. This is faster and cheaper. • •

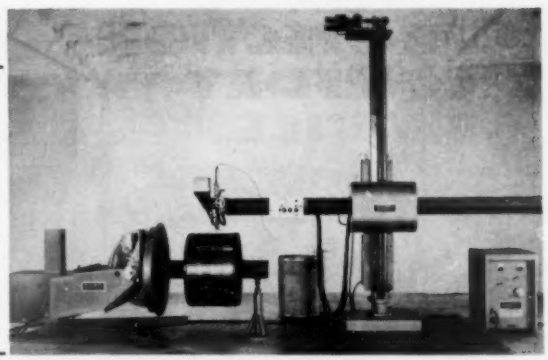
Announcing **3 NEW STOODY Automatic Welding Systems!**



Stoody has long been the recognized leader in alloy wires for automatic hard-facing as well as for hard-facing rods and electrodes. No other manufacturer offers equal experience or a product line so versatile and complete.

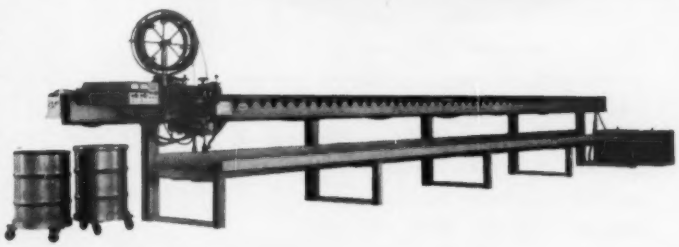
Now Stoody augments the best hard-facing materials available to industry *with a whole new line of automatic welding machines* covering specialized and general needs. Before investing in any automatic welding machines check with Stoody . . . pioneers and developers in the field of hard-facing, *manufacturers of the latest designs in AUTOMATIC WELDING SYSTEMS!*

1 **STOODY CRUSHERMATIC**—A compact, versatile system for automatically rebuilding and hard-facing crusher rolls in position. It enables the welder to work outside the crusher chassis in comfort and clean air. The Crushermatic consists of a motorized carriage riding a track which is suspended over the crusher roll. Wire is supplied to the carriage by any standard semi-automatic wire feeding unit. Uses a 400 amp power supply but 600 amps are preferable. Versatile electronic controls provide proper sequencing for a *variety of circumferential and transverse welding patterns.* The Crushermatic is portable by one man and is slipped into permanently welded brackets when in use. *It deposits up to 20 lbs. per hour—300% to 400% faster than manual welding and 200% faster than hand-held semi-automatic welding.*



2 **STOODY MODEL U W UNIVERSAL AUTOMATIC WELDER**—The Model U W provides a complete welding system capable of cylindrical, conical and straight line welding. The 3000 lb. capacity positioner *tilts the workpiece through a 120° angle and is equipped with power elevation and thyratron controlled rotation.* All electrical controls are unitized in a *portable control panel* for maximum operator convenience. *Ram type manipulator* has a vertical travel from 6" to 8'-6"; Horizontal travel: 10'; Travel speed range: 5 imp to approximately 60 ipm. Manipulator mast *rotates through 360°.* Power source: *DC, constant potential selenium rectifier type.* Input: 220-440 V, Output: 500 amps at 40 V 100% duty cycle. 5 point slope control.

3 **STOODY MODEL T L DUAL-HEAD TRACK LINK WELDER**—Provides dual welding heads with wires supplied from twin Payoffpaks for fast, efficient rebuilding and hard-facing. Extremely rugged construction. Features: *Special gear-type wire feed rolls; positive high frequency starters; wider, lower bed for easier accessibility and greater capacity; heavy-duty double worm reduction gear box with DC variable speed travel drive motor. Unitized control panel.* Bed length 40'; Bed width 46"; Bed height only 24"; Power: 2-500 amp constant voltage 100% duty cycle 220-440 V power sources.



• *For full information on all STOODY AUTOMATIC WELDING SYSTEMS see your Stoody dealer (check the Yellow Pages of your phone book) or write direct.*

STOODY COMPANY
11982 E. Slauson Avenue, Whittier, California

For More Information Circle No. 75 on Reader Service Card.

For More Information Circle No. 27 on Reader Service Card.

DURO ELECTRODE HOLDERS

THE DURO "STANDARD"

- Featuring "Long Jaw Design" for reaching hard to get at places.
- Cool operation—cool handling.
- Insulated handle and guard protects the operator.
- All parts easily replaced.

THE "ADJUSTABLE TENSION"

- Easy adjusting of Spring Tension for your requirements.
- New type cable connection prevents fraying of cable.
- Aluminum model weighs only 13 oz.
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For further information write:

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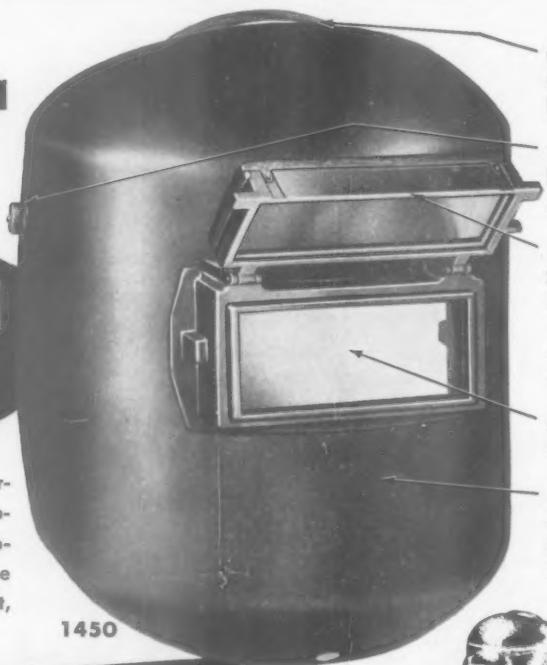


Comfortable, molded-fiber, quick-adjusting headgear.

Special spring pivot holds at any position, allows easy tip-up.

Lift-front holds Federal Spec. welding and cover lenses.

Adjustable headgear stop.

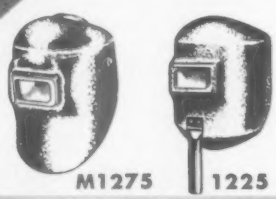
Clear lens for chipping or inspection.

Husky, one-piece, heavy gauge fibre glass or fibre, molded shell; heat, moisture, warp-proof.

1450

Dockson helments and handshields incorporate all the outstanding comfort and protection features so important in safety equipment today. Quality built for long service life, they are roomy, sturdy, lightweight, and fully adjustable for complete protection against sparks, flash, and dangerous arc welding rays.

Write for complete Safety Equipment Catalog



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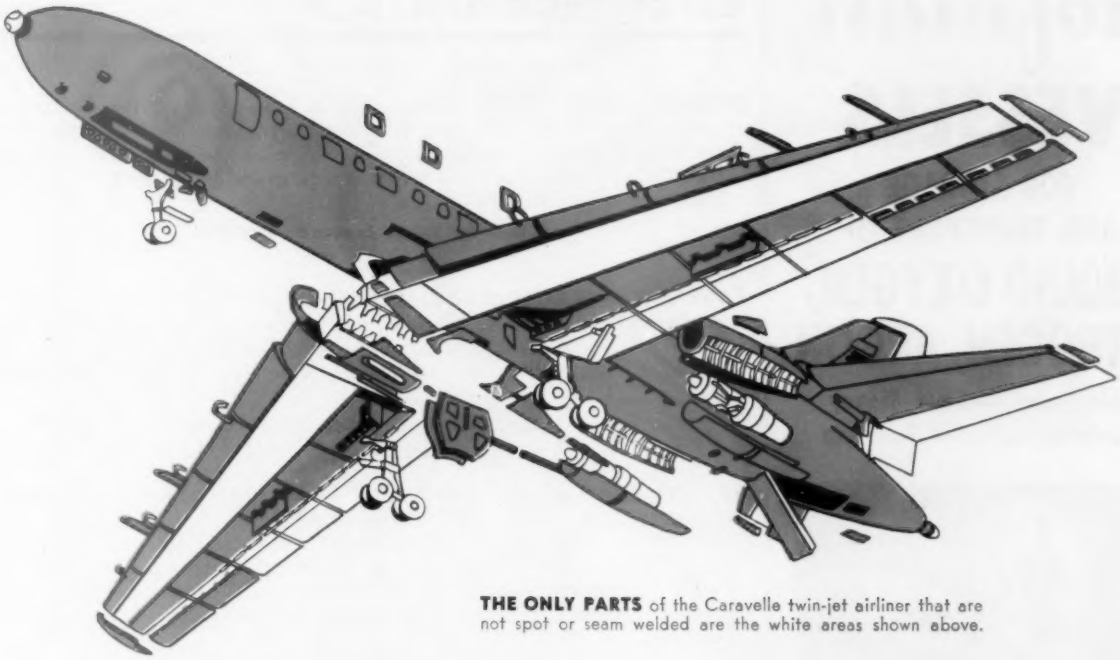


THE ONLY PARTS of the Caravelle twin-jet airliner that are not spot or seam welded are the white areas shown above.

French jet is designed for spot welding

IN BRIEF: A French aircraft manufacturer gives four important reasons why they use spot welding on their twin-jet-plane.

PARIS: The Caravelle is almost entirely spotwelded. It is manufactured by Sud-Aviation, the world's sixth largest aircraft manufacturer. The twin-jet, medium range airliner, has a wing span of 112 feet, length—105 feet. The outstanding feature of the Caravelle is the location of the engines. They are on either side of the rear fuselage section.

With the exception of the wing spar box and several other parts, the Caravelle was designed to be spot welded.

WHY SPOTWELD?

Sud-Aviation lists these reasons:

- A smoother outside surface.
- Excellent sealing for pressurizing at high altitudes.
- High resistance to fatigue and static loads.
- Cheaper than riveting.

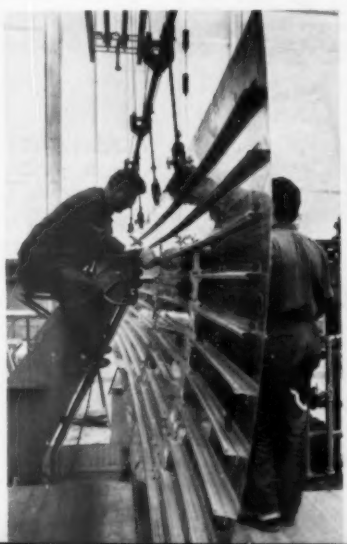
ALUMINUM AIRFRAME

The craft is fabricated mostly of aluminum. All parts to be welded are pickled in a high temperature nitric acid solution. Pickling is held to strict specifications to lower contact resistance, and keep it constant. This produces a superior weld.

The manufacturer welds with spot welders with vertical electrodes, spot-welders with horizontal electrodes, and seam welders. All machinery at Sud is of the latest design.

After welding, the entire assembly is treated with a solution of Alodine 1200 to protect it from corrosion. Sud makes frequent inspections to control tensile strength. They follow them with metallographic and radiographic inspections of 5 percent of the spot welds. These are just a few of the many tests and manufacturing treatments adopted after extensive research.

The Caravelle is manufactured to be of the highest possible quality. It complies with French and American regulations. • •



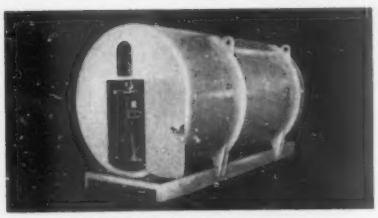
SPOT WELDERS with horizontal electrodes are used for correctly positioning double-curved aluminum panels.

hofman VESSELS

FOR STORAGE AND TRANSPORT OF

LIQUID OXYGEN, NITROGEN, ARGON

Save Space — Save Money
Eliminate Cylinder Handling



Hofman 300 gallon liquid oxygen storage vessel. Hofman storage vessels range from 15 to 28,000 gallon capacities.

Hofman 1000 gallon transport truck built for Southern Oxygen Co. Hofman transport vessels range from 500 to 4000 gallon capacities.

This Hofman central oxygen supply system includes a 300 gallon vertical storage vessel. System was built for Ohio Chemical Co.

Free!

New 64 page catalog. The largest line of low temperature equipment available. Also valuable cryogenic information.

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REFERENCE DATA *catalogs, handbooks, manuals*

DISCUSSION IN DEPTH, in the form of a 10-page, profusely illustrated and charted booklet published by Arcos Corporation, describes the Arcos-arc Process. Tells story of how this visible arc, semi- or fully-automatic metallic arc process, using CO_2 makes high-grade, high-speed welds. Seven charts give valuable welding data.

Circle No. 300 on Reader Service Card.

FABRICATED ELECTRICAL ENCLOSURES are the subject of a completely revised catalog issued by Machinery Eletcrification, Inc. Catalog SF gives complete construction details and specifications of standard units and explains how modified for special use. Quotes will be given on special designs.

Circle No. 301 on Reader Service Card.

ARC WELDING products information is contained in The Lincoln Electric Company's new bulletin 7000.7 entitled "Weldirectory of Arc Welding Electrodes, Equipment, and Supplies." The bulletin discusses AWS classifications, electrode selection, arc characteristics, welding procedures, and physical properties of electrodes. In addition, the bulletin describes the performance and construction features of Lincoln's arc welders and welding supplies.

Circle No. 302 on Reader Service Card.

AUTOMATIC PRECISION WELDING equipment for such miniature electronic parts as transistors and diodes is described in a new issue of Welding News, Volume 12, Number 2, issued by National Electric Welding Machine Co. The six-page, illustrated publication describes eight standard and special welders developed by the company, ranging from single point console units to dial feed designs capable of 2,700 pieces per hour.

Circle No. 303 on Reader Service Card.

POWER TOOLS and their accessories are described in a new 68-page catalog announced by Skill Corp. The catalog contains complete information on over 100 Skill power tools for use in industry, construction, automobile service, vocational training, maintenance, and other applications. Included are over two hundred illustrations, product features and applications, and specifications.

Circle No. 304 on Reader Service Card.

THE NEW METALS HANDBOOK, 8th Edition, Vol. 1, "Properties and Selection of Metals" is described in a 32-page illustrated brochure issued by the American Society for Metals. The brochure includes examples from each of the Handbook's major sections, with information on how the 1,300-page book was compiled by 1,335 metalworking experts.

Circle No. 305 on Reader Service Card.

"FLASH BUTT-WELDING RINGS: How they are Made," is the title of an illustrated 20-page booklet from The American Welding & Manufacturing Company's Industrial Division. Graphs, drawings, and illustrations describes steps of the flash butt-welding ring manufacturing process. Some sections of particular interest include: Major Advantages, Quality Control, and Question and Answers.

Circle No. 306 on Reader Service Card.

FACTS AT YOUR FINGERTIPS: *If you want copies of the catalogs featured on these pages, just circle the appropriate numbers on the bound-in Reader Service Card. We'll do the rest.*

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fabricators for industry, with quality and service born of experience in meeting exacting standards. Construction and warehousing facilities to provide a balanced steel service.

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He goes out of his way to make that special delivery

You can't make the deadline if you lack gases, equipment or supplies to do the job. So why take a chance? Call your Airco Distributor. He'll break all records to see that you get *all* that you need *when* you need it. His service and practical know how are backed up with Airco's years of welding experience.

For high production or high precision, choose from the **AIRCO** quality line of gas cutting and welding equipment — flame cutting machines — arc welding equipment and arc welders — gas-shielded arc welding process equipment — high purity and rare industrial gases — electrodes — supplies and accessories.

Call your nearby Airco Distributor. He's listed in your Classified Telephone Directory under "Welding Equipment and Supplies."

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Circle No. 3 on Reader Service Card.

HOW LARGE COMPONENTS and complete machines are fabricated, machined and assembled by R. C. Mahon's Steel-Weld Division is explained in Bulletin SW-60, an up-dated facilities and capabilities brochure.

Circle No. 307 on Reader Service Card.

WELDED STEEL TUBING is the subject of a 4-page, illustrated brochure just published by Epps Industries, Inc. The 2-color brochure lists applications for round and square welded steel tubing and contains a discussion of the tolerances permissible in size, flash, ovality and straightness; cutting and deburring lengths limits are defined.

Circle No. 308 on Reader Service Card.

"HARD FACING ALLOYS IN COILS" is a revision of a technical data sheet for the Wear-Resistant Literature Binder issued by Haynes Stellite Company, Division of Union Carbide Corp. Nominal compositions for the tube red alloys are now given as deposit compositions, not as rod compositions. Changes are also indicated for application procedures.

Circle No. 309 on Reader Service Card.

HOW ON-THE-JOB CUTTING of all metals can speed fitting, assembly, and construction operations is explained in literature from Fenway Machine Co., Inc. A brochure explains how the company's complete line of portable nibblers can easily make all cuts in a variety of metals and metal thicknesses.

Circle No. 310 on Reader Service Card.

CATALOG INFORMATION describes and illustrates the usefulness of Jorgensen Hold-Down Clamps with exclusive patented steel welder's shield for welding service. Published by Adjustable Clamp Co.

Circle No. 311 on Reader Service Card.

HOME STUDY course for weld quality and inspection is being offered by National Technical Training Services. This full length 14 lesson course covers all aspects of weld faults, inspection, and testing.

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For More Information Circle No. 51 on Reader Service Card.

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forge hammers

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MOTOR DRIVEN

Extremely powerful yet comparatively simple in design, MURCO Power Driven Forge Hammers can be operated under perfect control and with very little effort. Illustrated are the five sizes of motor driven models made in 25; 50; 100; 250; and 500 pounds RAM. The RAM design is a special feature . . . a steel casting, balanced and carefully machined, operates in V guides . . . large bearings for toe and toggle bolts . . . guide bearings extra long and wide. Perfect alignment of Ram Travel prevents twisting because the Ram is parallel with travel—a very important feature. Write today for complete specifications and price on the model to meet your requirements.

MURCO Power Driven Forge Hammers are also made in five models belt driven in 25; 50; 100; 250; and 500 pound ram sizes.

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Model GR II Cut-Off Machine by Stone

. . . phenomenal cutting life with super-strong steel saw blade plus special attachments for coping, mitre and notch cuts

POWERED by full 10 hp, TEFC motor, with high overload capacity. Vertically adjustable drive unit for selection of precise cutting angles.

From job shop to production, you can now cut metal at maximum speed and low, low cost with the efficient Model GRII Cut-Off Machine – newest metal-cutting money saver from Stone Machinery Co.

Rugged powerhouse built for the long pull with minimum maintenance, it sets up quickly *without clamping*. Cutting blade is fed to stock on short traverse . . . cuts wide range of metals remarkably fast.

Stone's new Cut-Off Machine achieves amazingly high cutting speeds with long life between sharpenings.

• ***SEND FOR FULL DETAILS*** about the speed, simplicity and savings you can realize with the new GR Model Cut-Off Machines and other Stone metal-cutting machinery.

Stone MACHINERY CO., INC.

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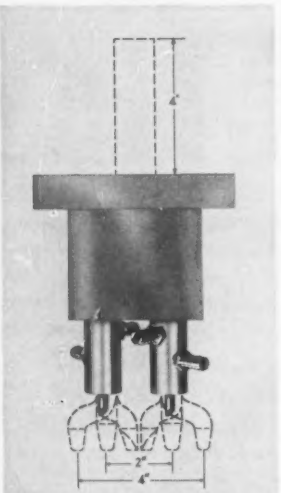
HIGH SPEED CUTTING MACHINERY

For More Information Circle No. 74 on Reader Service Card.

Double-Barrelled Tip Holder Makes Two Equal-Pressure Welds

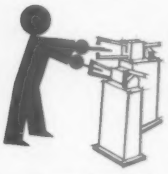


Absolute fidelity of spacing between welds, in a range from 0 to 4", is accomplished by using Tuffaloy bent offset tips as diagramed above.

The TUFFALOY Equa-Press* Dual Holder makes two spot welds at once, and makes them precisely alike. Upon contacting the work piece, the forging pressure is automatically equalized between the two electrodes, regardless of minor variations in work thickness or electrode wear (up to 3/16").

The two tip-holding barrels are sliding pistons, whose movements are controlled by a mechanical equalizing device sealed in the housing. Maximum conductivity is maintained through the copper-alloy working parts, and water coolant fittings are provided.

Models are made for mounting in a welder arm (above) or for bolting to a press welder platen (left).



Doc Tuffy says . . . you'll almost double your output of closely-spaced welds without adding a man, with the TUFFALOY Equa-Press Dual Holder!

There is an AIRCO or TUFFALOY distributor near you. Call him and ask to see the Equa-Press Dual Holder. Ask him too for the TUFFALOY Catalog . . . it makes correct resistance welding electrode specifications easy.

*Airco trademark

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For More Information Circle No. 4 on Reader Service Card.

STUD WELDING UNITS to be used with any d.c. welding power source are featured in literature from K S M Products, Inc. Two units, Mark XI for stud-welding all fasteners and Bantam for fasteners 1/8 thru 3/8 inch in diameter, are illustrated.

Circle No. 313 on Reader Service Card.

MOTOR CONTROL is the subject of Bulletin 343 released by Sciaky Bros., Inc. describing their Sciaky-dyne Zero-Error control. Literature tells how control regulates speed and positions on numerically controlled machine tools, automatic fusion welding equipment, material processing equipment, and manipulators.

Circle No. 314 on Reader Service Card.

BRAZING ALLOY FLOW CONTROL is the subject of a 2-page Nicrobraz engineering data sheet (No. 2.2.1) available from the Stainless Processing Division, Wall Colomonoy Corp. The literature explains how Nicrobraz Green Stop-Off is used in a variety of applications.

Circle No 315 on Reader Service Card.

IGNITRON EXCITATION CIRCUITS are the subject of Bulletin PT-50 from General Electric's Power Tube Department. The 16-page publication explains the functions of the associated electrodes (anode, grid and ignitor) and details typical circuits which assure accurate and reliable firing. A selection chart is included.

Circle No. 316 on Reader Service Card.

AN ELECTRIC ARC GUN which serves as a spot welder, stud welder, tack welder, button welder, hole burner, and riveter is the subject of literature from Beeco Manufacturing Corp. The gun is illustrated and various nozzle attachments for specific applications are featured.

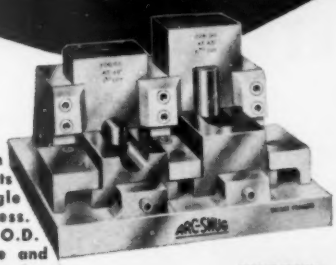
Circle No. 317 on Reader Service Card.

HIGH FREQUENCY ELECTRIC TOOLS made by Thor Power Tool Company are described and illustrated in a new 32-page catalog. The catalog explains the advantages of using 180, 360, and 400 cycle tools for grinding, sanding, polishing, drilling, reaming.

Circle No. 318 on Reader Service Card.

For More Information Circle No. 82 on Reader Service Card.

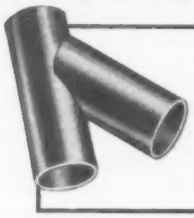
Cuts the FASTEST and FINEST NOTCHES Ever Made!



ARC-SNUG

ARC-SNUG gives you clean-edge, close-fitting, true contour notching by making both the first and second cuts of the notch in a single downstroke of the press. Notches ½" to 1¼" O.D. metal tubing (16 gauge and under) at angles ranging from 35 to 90 degrees. Special sizes and special dies to cut stainless steel, Monel metal, etc., made to order. Dies for various angles and sizes are interchangeable. Write for literature.

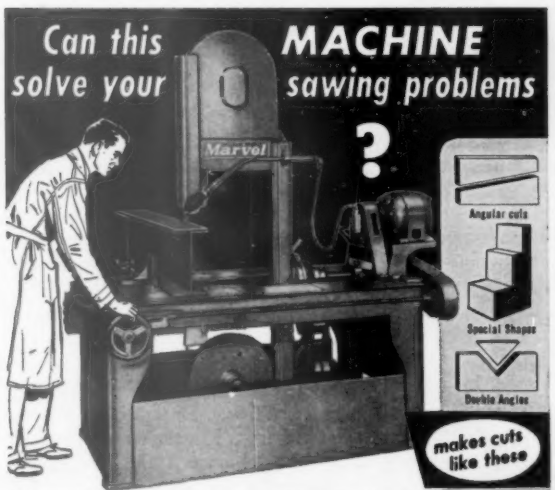
NOTCHED SAMPLES GLADLY FURNISHED



Combines 2 operations in one... to give you the snuggest fitting, angular tubing joints for cheaper, quicker, easier welding.

VOGEL TOOL & DIE CORPORATION
1819 NORTH 32ND AVENUE • STONE PARK, ILLINOIS

Can this MACHINE solve your sawing problems ?



If your metal sawing requirements are many and varied . . . if you have to cut the smallest, most delicate work or heavy solids up to 18"x18" . . . if you cut-off bar stock, pipe, tubing, moulding or structural shapes—then this MARVEL No. 8 Band Saw is the machine for you.

Not only is the MARVEL No. 8 Band Saw a truly universal machine capable of handling virtually any metal sawing job, but it does its work with unmatched efficiency, economy, and ease of operation. Many exclusive No. 8 Band Saw design and operating features such as vertical column design, control tower visibility, column and blade tilting to any angle up to 45° right or left of vertical for cutting at an angle or miter, are described in Bulletin 875. Write for it today. If you'd like a demonstration, mention the fact in your inquiry, and we'll arrange it at your convenience.

ARMSTRONG-BLUM MFG. CO.
5700 West Bloomingdale Avenue, Chicago, U.S.A.

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Reclaim REJECTS GOOD AS NEW with---

LOW COST **MOGUL®**

METALLIZING

SALVAGE CUSTOMERS' $$$ AND TIME ON DEFECTIVE OR WORN PARTS . . . BUILD SHOP PROFITS!

Metallizing Guns Spray On carbon, stainless steels, babbitts, bronze, nickel, brass, aluminum, tin, zinc; hard ceramic facings, to correct mis-machining, wear, or damage. Keep your shop humming profitably.

Rebuild GOOD AS NEW! SAVE UP TO 90% OF REPLACEMENT COSTS even on giants such as a $4,000 centrifugal pump part. Avoid costly downtime awaiting new parts, too.

POWDER-JET® GUNS spray ceramic hard facing alloys, metal powders.

TURBO-JET® GUN with patented Magnetic Governor Controls — sprays wires or rods.

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METALLIZING COMPANY OF AMERICA, INC.
3520 W. Carroll Ave. • Chicago 24, Ill.

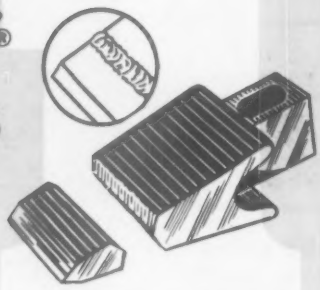
For More Information Circle No. 53 on Reader Service Card.

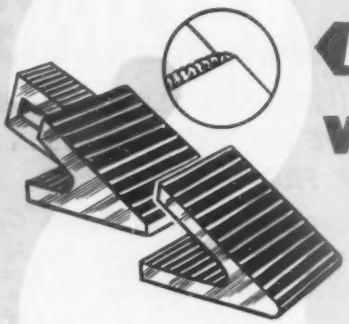
THREE GOOD WAYS TO... REPOINT SHOVEL TEETH- FAST

COSTS LESS THAN NEW TEETH!
QUICK, EASY WELDING METHOD!

HEAVY-DUTY
MANGANAL®
11% - 13½% MANGANESE-NICKEL STEEL
WEDGE BARS

Available in many sizes to fit any repointing requirement.





HEAVY-DUTY
MANGANAL®
11%-14% MANGANESE STEEL
WING-DING®
INDIVIDUAL SLIPOVERS

Available in nine sizes. Builds up tooth face and repoints in one operation.

SS CRESCENTS
WEAR-RESISTANT ALLOY STEEL
TOOTH POINTS

Available in four sizes. For quick sharpness to give easy digging.

Available from all welding distributors.
Nearest Distributor Upon Request. Send for Helpful Literature.

NATIONAL WELDING SUPPLY ASSOCIATION MEMBER

STULZ-SICKLES CO.
929 Julia Street • Elizabeth, New Jersey

For More Information Circle No. 76 on Reader Service Card.

MODERN HEAVY-DUTY GAS CUTTING Machines is the title of a 15-page technical treatise describing the latest equipment and guidance techniques. Included are discussions on cutting large forgings, plate-edge preparation, structural requirements, and handling. Many diagrams and illustrations are included in this book from Messer Cutting Machines, Inc.

Circle No. 319 on Reader Service Card.

STANDARD COATED ABRASIVE products used throughout industry are listed in a "Catalog of National Standard Abrasive Belts, Rolls, Sheets and Discs," By The Carborundum Company's Coated Abrasives Division. All items listed are stocked at Carborundum's warehouses.

Circle No. 320 on Reader Service Card.

COOL WELDING CONNECTIONS are the subject of a new bulletin, Welding's Vital Links, issued by J. B. Nottingham & Co. Publication explains that poor connections not only waste power, but impair weld quality. Thirteen ways are given for judging the quality of welding connections; each connection should be as electrically and mechanically good as the cable it joins.

Circle No. 321 on Reader Service Card.

CUT-OFF MACHINES and other metal cutting machinery made by Stone Machinery Co., Inc., are featured in literature. Speed, simplicity, and savings made possible by the machines are explained.

Circle No. 74 on Reader Service Card.

TIG WELDING products made by Tec Torch Co., Inc., are featured in a brochure. Described and illustrated are a variety of torches, offset chucks and nozzles, and Vycor Visuweld nozzles.

Circle No. 78 on Reader Service Card.

FACILITIES FOR DESIGN, welding and fabricating weldments from 1- to 35-tons are described in a booklet from Lewis Welding & Engineering Co. The brochure also shows a variety of heavy-duty machine tools available for precise finishing of large welded structures and components. Special machines are also listed.

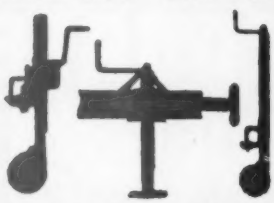
Circle No. 45 on Reader Service Card.

a constant source of business for you...

A complete line of - Axle Assemblies, Trailer Undercarriages, Farm & Trailer Jacks, Implement & Trailer Couplers, Spindle End Assemblies

BULL DOG AXLE ASSEMBLIES

BULL DOG JACKS



BULL DOG COUPLERS

A COMPLETE LINE OF COUPLERS

SPINDLE END ASSEMBLIES

Complete Spindle End Assemblies for 2,500, 4,000 and 5,000 lb. capacities Per Pair. Available in complete assemblies or individual parts — Spindle Ends, Hubs, Wheels.

Contact our engineering department for full details on your particular application — a FREE service to you — write for Catalog 18-E

HAMMER BLOW TOOL CO.

WAUSAU • WISCONSIN

Circle No. 35 on Reader Service Card.

HOW BEVELING TIME on small weldments can be cut 85 percent is explained in literature from American Pullmax Co., Inc. A brochure describes in detail how the company's Pullmax Beveller can be used to bevel cut small plate in both straight and mild radius shapes at speeds up to 11 ipm.

Circle No. 9 on Reader Service Card.

TEMPERATURE INDICATING sticks, pellets and liquids are the subject of literature available from Markal Company. Sticks are available for temperatures from 113°F to 2,000°F. Liquids and pellets are available for a wide range of temperatures.

Circle No. 51 on Reader Service Card.

PORTABLE SANDBLASTER that removes corrosion, paint, scale, flux, is featured in literature from Hamill Manufacturing Co., Inc. Model 28A Handi-Blast pressure-type unit is described as small, compact, and completely portable.

Circle No. 322 on Reader Service Card.

POSITIVE POWER connections and how to get them for arc welding is explained in literature from Cam-Lok Division of Empire Products, Inc. Described and illustrated are connectors, receptacles, and plugs.

Circle No. 19 on Reader Service Card.

REFERENCE DATA CHARTS covering bronze welding electrodes, bare filler rods arc wire are available from Ampco Metal, Inc. Included in the charts is information on comparative bronze electrodes, melting rates and efficiencies, electrode and filler rod specifications, and recommended welding currents for various welding procedures.

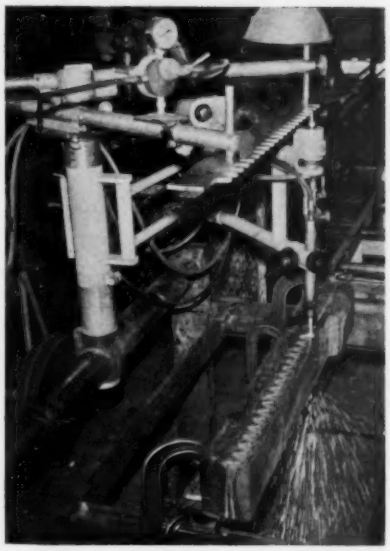
Circle No. 323 on Reader Service Card.

ANYBODY'S PRIVILEGE

You may request more data on any item in this magazine that has a Reader Service Number by circling that number on the Reader Service Card, regardless of whether or not you are the subscriber to whom the magazine was addressed.

with a Heath Ultra-Graph

Accuracy lowers production cost



Controlled flame cutting reduced costs on a short run of these large racks

Starting with a rough forging of special 8822 alloy steel, 5 7/8" deep and 157" long, twenty-one teeth were accurately shaped to close tolerances. In 23 minutes more than 120 lbs. of metal had been removed. The rack was ready for final finishing.

A quick comparison of processing costs points out the economic advantages of flame cutting on short run items such as this. Flame cutting with an Ultra-Graph does not require costly tooling connected with forging. Flame cutting saves many hours of setup and production time over machining when large areas of metal must be removed.

Send now for more information on cost reduction with Ultra-Graph machines or see your Welding Supply Dealer for a demonstration.

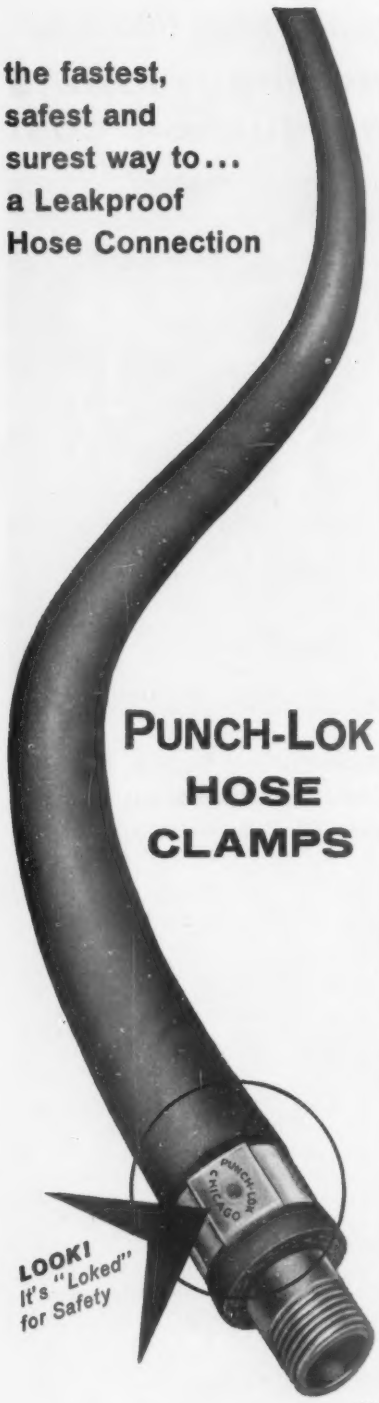
HEATH ENGINEERING COMPANY

P. O. BOX 821
FORT COLLINS, COLORADO

Circle No. 37 on Reader Service Card.

the fastest,
safest and
surest way to...
a Leakproof
Hose Connection

PUNCH-LOK
HOSE
CLAMPS



LOOK!
It's "Loked"
for Safety

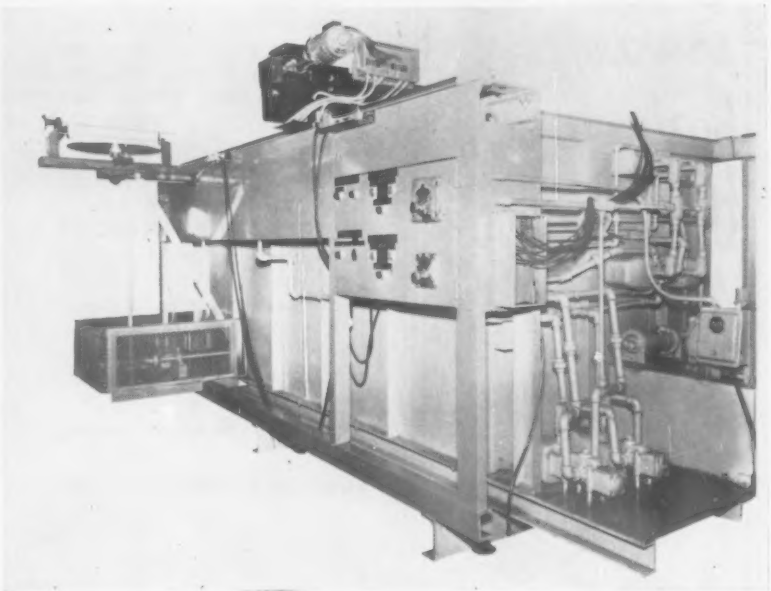
See Your Distributor
or write direct for catalog and prices

The Sign of a GOOD Hose Clamp

PUNCH-LOK
Company

Dept. X, 321 N. Justine St., Chicago 7, Ill.
Circle No. 67 on Reader Service Card.

NEW PRODUCTS



Ultrasonic Scanner

The Circo Equipment Co. has designed an automatized ultrasonic flaw detection scanner said to be one of the largest and most unique ever developed. Designed to Pratt & Whitney specifications for missile and aircraft parts testing, the unit scans three ways: horizontally, rotating, and spirally. It will examine almost any shape.

Circle No. 200 on Reader Service Card.

NEW from GLENDALE

REVOLUTIONARY
"Seesall Cover-Spec Goggles"

WITH ANGLED
LENS DESIGN
give the
TOTAL VISION
plant safety directors
have been looking for in
Welders' Goggles.

NEW FEATURES:
- Blind spots eliminated
- Take in entire work area
- A boon to bi-focal wearers
- End neck fatigue, worker strain
- Fit over all spectacles
- Lightweight construction

Full details and specifications on request.

Write for new 1961 catalog

GLENDALE OPTICAL CO., Inc.
600 W. MERRICK ROAD, VALLEY STREAM, N. Y.
• S-7 SPECTACLES & LENSES • FACE SHIELDS • WELDER'S AND CHIPPER'S GOGGLES
• DUST GOGGLES • ACID & CHEMICAL GOGGLES • FLASH SPECTACLES •
PLASTIC EYESHIELDS • CHIPPING & GRINDING SPECTACLES • WELDING PLATES & LENSES

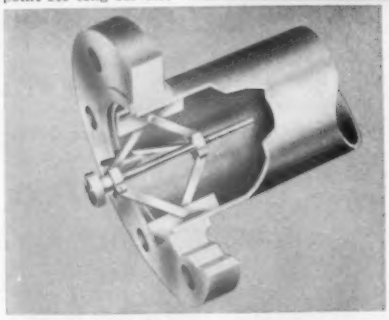
For More Information Circle No. 42 on Reader Service Card.

CURV-O-MARK

A CONTOUR MARKER PRODUCT

CENTERING HEADS

Actually, it's five tools in one—replaces protractor, centering head, center punch, level and scale. Y-Type head is accurately machined with tangents and tips to serve in centering and aligning. Dial set level is marked in 2-½ and 10 degree graduations for easy reading. Punch is of drill rod, with special point for long service.



FLANGE ALIGNING TOOL

This self-centering tool makes pipe line construction faster and more accurate. It is quickly adjustable for all type of flanges or pipe sizes ranging from 3 to 12 inch diameters.

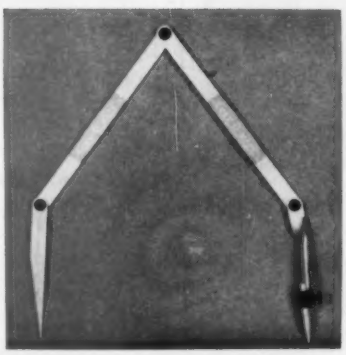
After easy insertion in pipe, Flange aligning tool centers itself snugly against the inside pipe diameter and automatically aligns with pipe axis.

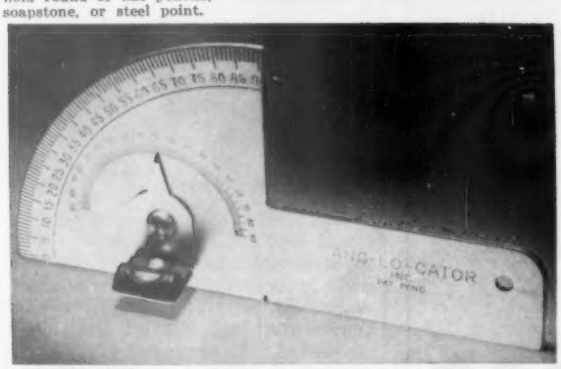
RADIUS MARKER

The Standard Radius Marker folds to pocket size. This sturdy, folding Radius Marker has a span of 24" and easily swings a 48" circle or arc.

The Jumbo Radius Marker is also the folding type, has a span of 48" and easily swings a 96" circle. These tools are precision made of rust proof aluminum dural.

The Standard Radius Marker folded, measures only 9¼" in length, weighing only 8 oz. The Jumbo model, of course, is larger. Both are equipped with special spring washers to maintain accuracy and rigidity for years of service. Pencil holder is made to hold round or flat pencils, soapstone, or steel point.





PROTRACTOR

The Ang-Lo-Cator Protractor is the only measuring device that quickly and accurately determines correct degree of angle on any pipe or structural material, regardless of size. A valuable aid to weldors, structural workers and pipe fitters. Size 4" x 8"

CONTOUR SALES CORP.

1843 East Compton Boulevard, Compton 2, California

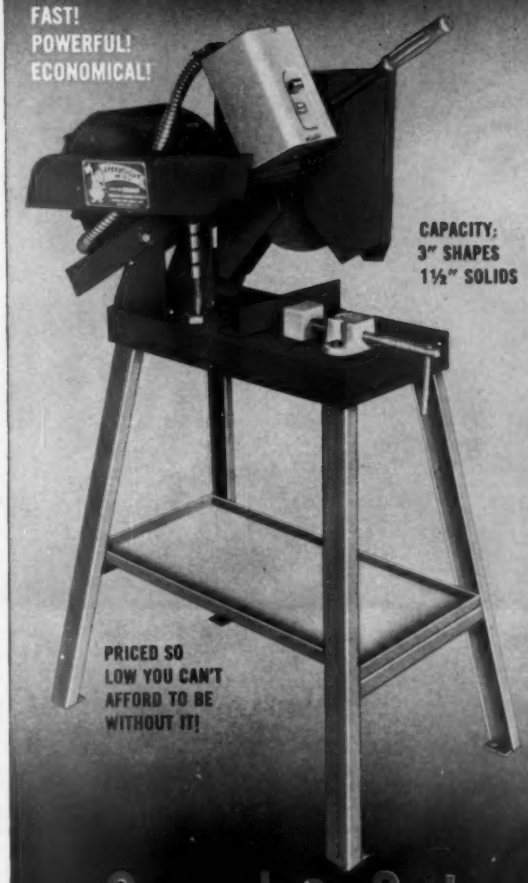
See Your Welding Supply Dealer For All Curv-O-Mark Products

For More Information Circle No. 24 on Reader Service Card.

New! No.11 Speed Cut

A BUDGET-SIZE CUTOFF FOR EVERY SIZE SHOP!

FAST!
POWERFUL!
ECONOMICAL!



CAPACITY:
3" SHAPES
1½" SOLIDS

PRICED SO LOW YOU CAN'T AFFORD TO BE WITHOUT IT!

Speed Cut

Abrasive Cutting Machines

MANUAL OR POWER-OPERATED MODELS
FOR WET, DRY OR ANY-ANGLE CUTTING!

Speed Cut

Send for complete catalog and name of nearest distributor

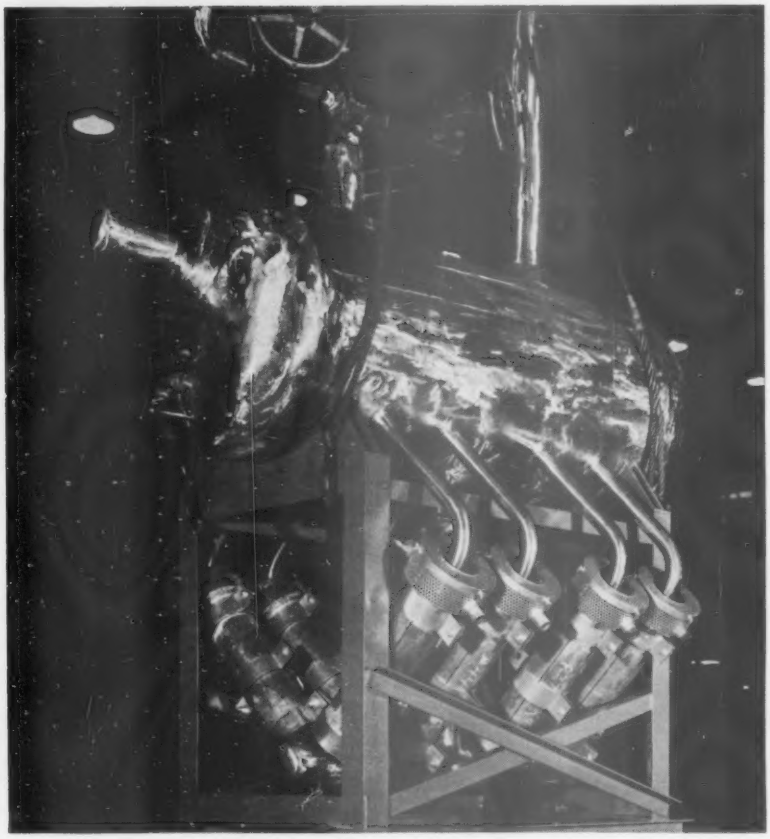
ABRASIVE MACHINE DIV.

BEAVER PIPE TOOLS, INC.

DANA AVE.
WARREN, OHIO

For More Information Circle No. 15 on Reader Service Card.

ARCOS EB INSERT FOR ROOT PASS WELDING



Job report courtesy of Dominion Bridge Co., Ltd., Montreal, Quebec

Smooth, crack-free root welds made in nuclear pressure vessel from one side only. This NRU reactor surge tank is made of Type 347 stainless, 3" thick with 26" I.D. It is designed for operation up to 630°F. at 2400 psi. Because welding could be done from the outside only, Arcos EB Consumable Weld Inserts were used for the root passes. Result: complete fusion, crack-free, with smooth inner surface. Write today for complete data on EB Weld Inserts.

ARCOS

Arcos Corporation • 1500 S. 50th St. • Philadelphia 43, Pa.

For More Information Circle No. 12 on Reader Service Card.

Universal Welder

A new universal a.c.-d.c. arc welder, with adaptable auxiliary equipment to enable its use on any type job, has been introduced by the Westing-Arc Division of Westinghouse Electric Corp. This 300-ampere silicon rectifier, Model TR, operates from single phase a.c. and delivers a.c., or straight or reverse polarity d.c. Intensity is controlled by a stepless rheostat; water and gas are controlled automatically by solenoid valves.

Circle No. 202 on Reader Service Card.

Electronic Governor

Linde Company has announced a heavy-duty electronic governor for speed control of shunt-wound d.c. motors up to one hp. The governor keeps motor speed constant at any setting despite variations in load, line voltage, or motor temperature. Operating from a 230-volt, 50-60-cycle single-phase line, the unit is available as a stripped chassis or in a cabinet.

Circle No. 203 on Reader Service Card.

Superstrong Steel

Great Lakes Steel division of National Steel Corp. has developed a new superstrength, weight-saving steel to make transport and storage pressure vessels 32 percent lighter than with conventional high strength steels. The steel's ASME-approved properties are: tensile strength, 115,000 to 135,000 psi; yield strength, 100,000 psi; maximum design stress, 28,750 psi. It is 54 percent stronger than conventional high strength steels. Because less steel is required, pressure-vessel welding costs are up to 40 percent less and shipping is cheaper.

Circle No. 204 on Reader Service Card.

Low Temperature Solder

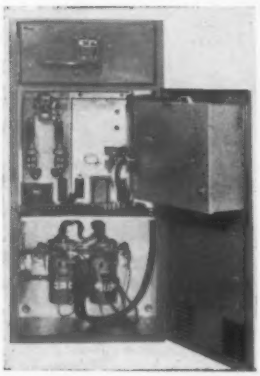
A low temperature fluxless solder, Tin-A-Lum, for joining aluminum and its alloys, zinc, tin, pewter, magnesium, and castings is being marketed by Metals for Industry, Inc. Tin-A-Lum, applied with a soldering iron or light flame, will join dissimilar metals without a flux.

Circle No. 205 on Reader Service Card.

Acetylene Cylinder Valve

A new O-ring type acetylene cylinder valve has been developed by the RegO Division, Bastian-Blessing Company. Called RegO 600, the series is said to take less maintenance and operate easier than the usual packed, wrench-operated valve. A nylon valve seat-disc assures positive shutoff.

Circle No. 206 on Reader Service Card.

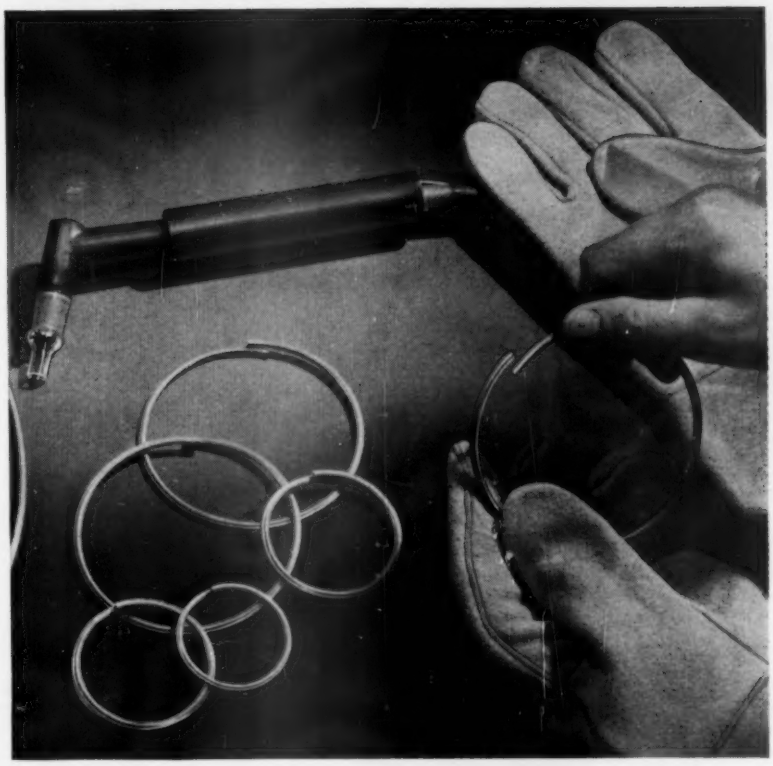


Transistorized Welder Control

A new line of resistance welder controls has been announced by Square D Company. An extension of the Square D Norpak static welder control system, the new controls use transistor time and switching circuits. Down time is practically eliminated because of the extended life and reliability of transistors. Better weld quality is just one advantage of this control.

Circle No. 207 on Reader Service Card.

ARCOS EB* INSERT FOR ROOT PASS WELDING



When pipe joints must be completely dependable. The Arcos EB Weld Insert produces smooth, uniform, crevice-free root pass welds that do not cause turbulence or impede liquid flow. It is used for making root passes where accessibility is limited to one side and where highest quality in the root pass is essential to the integrity of the completed weld. A new booklet describing the Arcos EB Weld Insert is yours for the asking. Write for your copy today.

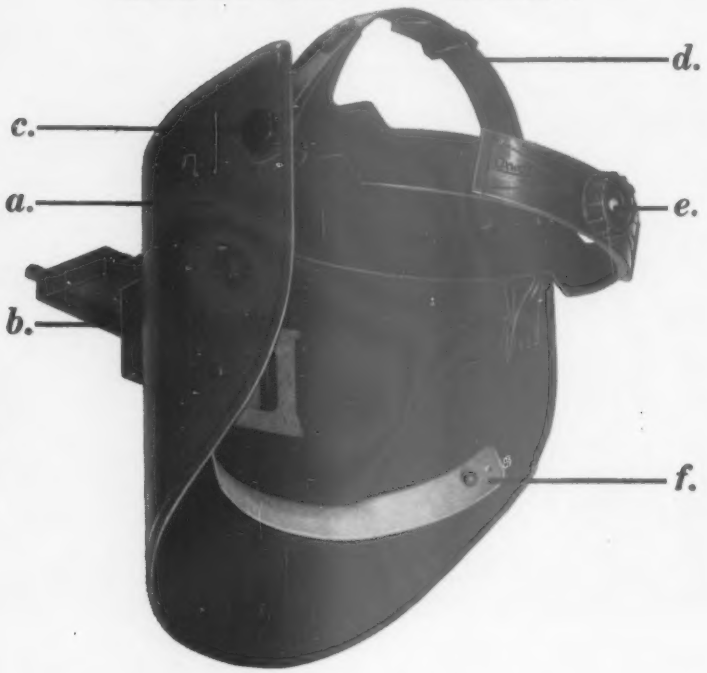
*Registered trademark of the
Electric Boat Division of General Dynamics Corporation

ARCOS

Arcos Corporation • 1500 S. 50th St. • Philadelphia 43, Pa.

For More Information Circle No. 13 on Reader Service Card.

Next time you pick up your helmet...see if it gives you all the advantages of this OXWELD helmet



a. *One-piece seamless shell* molded from tough glass-fiber-reinforced polyester resin—lightweight, easily cleaned, strong, non-warping.

b. *Flip-front glassholder* die-cast from aluminum, stationary glassholder molded as integral part of shell for a light-tight seal.

c. *Fingertip tension adjustment* to hold helmet in up or down position. "CP" joints of durable plastic will not pass electric current.

d. *Adustable crown strap* holds helmet firmly in choice of five positions.

e. *Rear knob* instantly adjusts headband size over wide range without need for removing helmet.

f. *Adustable fiber chin rest* assures proper visual alignment and maximum comfort.

Compare these advantages with those offered by any other helmet. There are eight different types of OXWELD helmets and hand-shields. And each is designed with every advanced feature for maximum protection against infra-red and ultra-violet rays, sparks, and molten metal.

Comfort is a big factor. OXWELD helmets have been given the careful detailing that provides easy, instant adjustment, snug fit, and the "free-floating" suspension that eliminates pressure points. You can choose from three sturdy shell styles.

See them at your LINDE distributor's. Or write for literature and price lists. Linde Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, N.Y. *In Canada,* Union Carbide Canada Limited, Linde Gases Division, Toronto 12.

LINDE COMPANY

UNION CARBIDE

"Linde", "Oxweld", and "Union Carbide" are registered trade marks of Union Carbide Corporation.

For More Information Circle No. 48 on Reader Service Card.

Ignitron Exciter

A new, self-contained, solid state ignitron exciter and controller that prevents misfiring has been announced by Wallson Associates, Inc. The unit, called the Model 210 Trigatron, can fire practically all commercially available ignitrons for their full power range. Manual or automatic phase control is possible. Peak current is 60 amperes; peak voltage 150 max.; output isolation 3,000 volts rms.

Circle No. 208 on Reader Service Card.

Welder/Power Plant

An engine-driven d.c. welder that also serves as an a.c. power plant is the latest offering of Harnischfeger Corp. Rated at 200 amps, 50 percent duty cycle, this new P&H unit delivers 3½ KW, 120 volts a.c., and 60 cycle auxiliary current. Its two-cylinder, four-cycle, air-cooled 12.8 hp gasoline engine features an electric starter. The heavy-duty direct-drive generator has a.c. windings for auxiliary output, a cranking field, and 12-volt battery charging circuit.

Circle No. 209 on Reader Service Card.

AC/DC Welder

A new welder, available in 300-, 400-, and 500-amp sizes, has been introduced by Miller Electric Mfg. Co. The single-phase welder features: continuous current control, 80-volt open circuit, semimetallic rectifier, and forced-draft ventilation.

Circle No. 210 on Reader Service Card.

Hard Surfacing Electrode

A hard surfacing electrode for joining hard-to-weld metals such as austenitic manganese to carbon steel and to T-1 steel, and stainless to carbon steel, has been developed by McKay Company. Called Hardalloy 120, the electrode deposits have a limit of about 12 percent ferrite. This resists cracking as well as armor welding electrodes. Hardalloy 120 is an all-position electrode for either a.c. or d.c. welding.

Circle No. 211 on Reader Service Card.

Torch with Pilot Flame

The Acetylene Supply Co. has incorporated a built-in pilot flame in its Asco Torches. This pilot eliminates re-lighting during intermittent work. Two simple controls are the only moving parts: the main on-off knob, which also regulates the pilot flame, and a thumb button for controlling the size and intensity of the working flame. Standard kits and a complete line of interchangeable tips and accessories are available.

Circle No. 212 on Reader Service Card.

Bench Model Positioner

A compact 100-pound-capacity bench positioner has been announced by Ransome Company. Called Model B-1, it tilts the load a full 135 degrees and rotates it up to 6 rpm. The 65-pound unit is foot controlled. Its 14-inch table has four "T" slots for work attachment.

Circle No. 213 on Reader Service Card.

—your LINDE distributor!

Advice is only as economical as it's correct—especially when the subject is welding. The advice you get from your LINDE distributor is sound . . . he knows LINDE, and LINDE knows the subject of welding inside and out. What's more, he knows your special needs, because he's an independent local businessman, familiar with your area and it's industry.

Talk over your welding problems with him. You'll find his knowledge as complete as his stocks of equipment. And because LINDE has been a leading pioneer in welding for more than 50 years, his is backed up by authoritative technological facilities for getting fast, accurate information on problems that are out of the ordinary.

In fact, you can phone your LINDE distributor for quick delivery of both equipment and advice. Look him up in your classified directory, or write for his address to Linde Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, N.Y. *In Canada,* Union Carbide Canada Limited, Linde Gases Division, Toronto 12.

Your LINDE Distributor

"Where One Call Gets It All"

LINDE COMPANY UNION CARBIDE

"Linde" and "Union Carbide" are registered trade marks of Union Carbide Corporation.

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NEW SINGER SAFETY SHIELD

In the plant or on the job

★ LIGHTWEIGHT ★ RUST-PROOF
★ LOW COST ★ FIRE-RESISTANT
★ ASSEMBLED OR TAKEN APART IN MINUTES WITHOUT TOOLS

Just think of it—no hooks, no bolts, no screws. Ideal for welding, grinding, machining etc. or can be used straight line as a protecting divider. Rust-proof steel frame with heavy fire-resistant duck curtain—attaches in seconds with with heavy duty snap fasteners.

In 4 standard sizes:
18" x 42", 36" x 48", 36" x 60", 36" x 72"

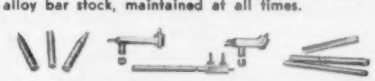
NEW BIG CATALOG
Describes screens in detail.
Complete line of work gloves, welding gloves and safety clothing.

Ask your dealer or write:
Special Products Division
SINGER GLOVE MFG. CO.
860 W. WEED St., CHICAGO 22, ILL.

Circle No. 72 on Reader Service Card.

"No secret—I use only virgin alloys in my spotwelding tips and machine them with the best equipment money can buy."

Resistance Welding Alloys our only product. An abundant inventory of spotwelding tips and related accessories, as well as the various grades of copper-alloy bar stock, maintained at all times.



tips—holders—wheels—copper alloy bar stock, forgings and castings

Catalog Available On Request

HERCULES WELDING PRODUCTS CO.
11478 Timken Ave., Warren, Michigan
JEfferson 9-2610

Circle No. 38 on Reader Service Card.

flaw hunter

you find cracks and hidden surface flaws

in ✓ **metals**
in ✓ **plastics**
in ✓ **ceramics**
in ✓ **glass**
in ✓ ***minutes***

USE PIXchek penetrant dye system for inspection after any metal-working process—casting, forging, welding, grinding, extruding, drawing, shearing—the gamut of operations. PIXchek is equally adaptable to single part or quantity-run inspection.

Everything you need is in this handy flaw-hunting kit

Sturdy steel hinged case with aerosol spray cans of PIXchek Dye, Cleaner, and Developer, plus extra cans of Dye and Cleaner for brush and wipe-on applications. The coupon below can start you flaw hunting right away.

$ only **35**

Picker x-ray

PICKER X-RAY CORPORATION
25 So. Broadway, White Plains, N. Y.

Please ship ☐ PIXchek Kits @ $35.00

Name_____ Title_____

Company_____

Address_____

City_____ Zone_____ State_____

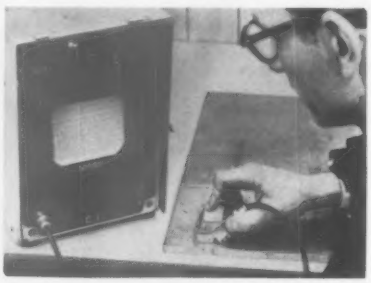
Purchase Order No._____

Circle No. 63 on Reader Service Card.

Large Grouser Bar

An extra-large grouser bar for giant crawler tractors has been announced by Allied Steel & Tractor Products, Inc. This replacement bar is 2-1/16 inches high, 1 inch wide, and weighs 5.3 pounds per foot. Made of a wear-resisting alloy steel, the bar has a patented shape that cuts installation time by 43 percent.

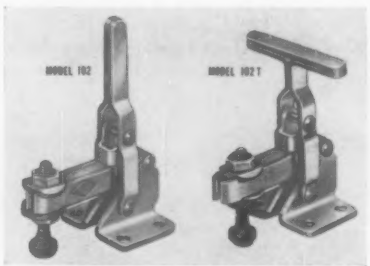
Circle No. 214 on Reader Service Card.



Angle-Beam Transducers

A new group of angle-beam transducers, for use with ultrasonic flaw-detection equipment, has been announced by Branson Instruments, Inc. Designed primarily for the company's Sonoray flaw detector, the transducers can be used with similar ultrasonic instruments. Branson is making three new types of angle-beam transducers, each offering variations in wedge angle as well as transducer size and operating frequency.

Circle No. 215 on Reader Service Card.



Miniaturized Toggle Clamps

Two miniaturized, vertical-handle toggle clamps rated at a 100-pound holding pressure have been added to the line of clamps manufactured by Detroit Stamping Company. Designated Model 102 and 102T clamps are available from stock with either a horizontal or straight base.

Circle No. 216 on Reader Service Card.

SPOOLED WIRE

USE SPOOLARC®

Rapid fabrication of aluminum window frames by metal inert-gas welding requires trouble free aluminum wire. Philadelphia manufacturer increased his production with mirror-finish All-State SPOOLARC®

for porosity-free welds... constant arc... better control ...fewer errors... faster work

Aluminum wire in all tempers now available in mirror finish, oil-free, precision layer wound spools. ALL-STATE's cleaning and tension controlled winding method produces wire free from helix (twist), permitting welds that do not walk.

Aluminum SPOOLARC® is packaged with desiccant in sealed plastic bags to eliminate moisture, a common cause of porosity in welds.

OTHER METALS—silicon bronze, deoxidized copper, aluminum bronze, phosphor bronze, magnesium, and nickel. Available in SPOOLARC® form. For more information on SPOOLARC® and other ALL-STATE products, send for free 56-page Instruction Manual and SPOOLARC® literature.

Available from distributors everywhere.

All-State

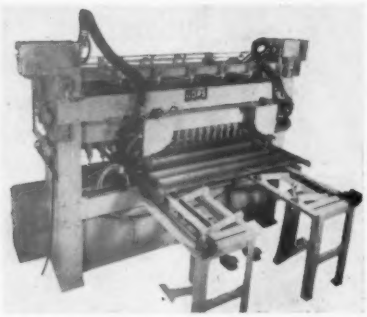
ALL-STATE WELDING ALLOYS CO., INC.
White Plains, N.Y. Dial 914 WH 8-4646
QUALITY WITH SERVICE

Circle No. 5 on Reader Service Card.

New X-Ray Paper

An industrial x-ray paper that costs half as much as standard x-ray film has been introduced by Picker X-Ray Corp. Called CAWO, the paper produces 4 to 6 percent sensitivity and is said to be excellent for finding flaws in weldments. CAWO paper can be seen without a special light because it is a print, not a film. You process CAWO the usual way, for durable fog-free prints.

Circle No. 217 on Reader Service Card.



24 Head Welder

A multiple-head resistance welding machine that can weld a desk top a minute (edge channels and stiffeners) has been announced by Lors Machinery, Inc. The model 240, 70 kva welder is readily adaptible for steel doors, partitions and sheet metal work. The welder operates from a standard 220 to 550 volt a.c. power source.

Circle No. 218 on Reader Service Card.

Sprayed Hard Facing

The Metallizing Co. of America has developed a powder spray gun that makes hard facing quick and economical. It applies self-fluxing nickel, chrome, boron, and/or silicon powders which are then fused to the base metal. This process is said to produce a dense, impermeable surface with a hardness characteristic of the applied metal.

Circle No. 219 on Reader Service Card.

Circle No. 64 on Reader Service Card.

product defects

getting you down?

let us help you...

- ***find hidden cracks*** with magnetic particle or dye penetrant inspection equipment
- ***find deep-lying defects*** with x-ray or gamma radiography equipment
- ***see "innards" directly*** with bright-image fluoroscopes
- ***work out the method*** at our Industrial Applications Lab

call any local Picker office

where a technical expert is always near (see 'phone book) or write

Picker x-ray

25 So. Broadway, White Plains, N.Y.

HARGRAVE
Power Tested
WELDERS' CLAMPS

Spatter Resisting
Solid Alloy Screw
Drilled Frame
For Ground

Forged Steel

In 3 Patterns
Regular Duty
Deep Reach
Heavy Duty

A SIZE AND PATTERN FOR EVERY JOB

SPRING | STD. CARRIAGE | FORGED STEEL

HEAVY DUTY | DEEP REACH | QUICK ACTING

CLAMP FIXTURES for ½" and ¾" pipe

BAR CLAMPS Light to Extra Heavy Duty

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THE CINCINNATI TOOL CO.
1985 Waverly Ave. • Cincinnati 12, Ohio

THERE IS A DISTRIBUTOR STOCK NEAR YOU

Circle No. 21 on Reader Service Card.

MORE PROFIT PER CU. FT. CUTS OVERHEAD 6 WAYS. NOW YOU NEED TO BUY, HANDLE, TRUCK, STORE, MAINTAIN AND DO "PAPER WORK" ON ONLY ONE CYLINDER IN ORDER TO SELL 1,000 CU. FT. OF GAS. ONE CYLINDER THAT TAKES LESS FLOOR SPACE THAN ANY COMBINATION OF SMALLER CYLINDERS; SPEEDS IN-PLANT HANDLING; DELIVERS MORE GAS ON EVERY TRUCK

ANOTHER FIRST BY

COYNE *cylinder company*

Division of AMERICAN CYROGENICS, INC.

224 Ryan Way
So. San Francisco, Calif.

155 W. Bodley Ave.
Memphis, Tenn.

3800 Springdale Ave.
Glenview, Ill.

For More Information Circle No. 25 on Reader Service Card.

Circle No. 65 on Reader Service Card.

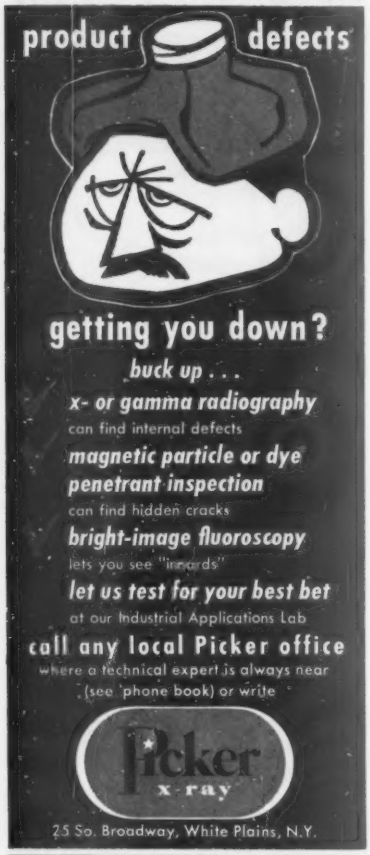
product defects
getting you down?
buck up . . .
x- or gamma radiography
can find internal defects
magnetic particle or dye penetrant inspection
can find hidden cracks
bright-image fluoroscopy
lets you see "innards"
let us test for your best bet
at our Industrial Applications Lab
call any local Picker office
where a technical expert is always near
(see 'phone book) or write
Picker x-ray
25 So. Broadway, White Plains, N.Y.

Photo Courtesy The Lincoln Electric Co.

NOW . . .
ONE AMMETER
for AC/DC WELDERS
Only TONG-TEST
measures both AC and DC

Weld with confidence. Use the exact amperage — no more, no less—to assure welding quality. Prevent costly rejects by controlling the welding current (AC or DC) with one TONG TEST AMMETER. Simply snap tongs around electrode cable — read amps instantly and accurately. No electrical connections required, cannot burn out. Interchangeable ranges up to 1000 amperes.

Write for Catalog W-400

COLUMBIA ELECTRIC MFG. CO.
4545 Hamilton Avenue • Cleveland 14, Ohio

Circle No. 23 on Reader Service Card.

Arc Welder

A new 500 amp. d.c. welder introduced by Welduction Corp. features a completely sealed cabinet and water-cooled transformers and rectifiers. The cabinet is only 13 inches deep, making the welder suitable for wall-, machine, or balcony-mounting. All components are accessible from the front through hinged doors, eliminating the need for removing sides and top for maintenance. Controls for slope, weld time and motor drive are contained in quick disconnect modules. The welder can be used for MIG, TIG, CO_2 and short arc processes.

A new pull-type MIG torch which houses the drive motor and tachometer feedback generator can also be provided. Features are light weight and extreme flexibility as conventional speedometer cable-driven drive systems are eliminated. Cable lengths up to 25-feet and more are provided.

Circle No. 220 on Reader Service Card.

ANYBODY'S PRIVILEGE

You may request more data on any item in this magazine that has a Reader Service Number by circling that number on the Reader Service Card, regardless of whether or not you are the subscriber to whom the magazine was addressed.

Heat, Time, and Pressure

New Weltronic Co. control balances all three for good resistance welds: Pressure is high for clamping, low for welding, just right for followup. Weld time, heat, and pressure are automatically corrected to suit the thickness, or number of thicknesses, of the metal being welded.

Circle No. 221 on Reader Service Card.

WELD WITH Tipaloy

YOUR Resistance Welding Electrode NEEDS Are OUR Business!

Whether it be:
TIPS:
ROD or BAR:
SEAM WELDING WHEELS:
FORGINGS:
CASTINGS:
HOLDERS:
ADAPTERS:

SPECIAL WELDING DIES or FIXTURES: TIPALOY *has them.*

BUY TIPALOY and save money!

TIPALOY can supply you with:
RWMA Class #1, Tipaloy #100
RWMA Class #2, Tipaloy #130*
RWMA Class #3, Tipaloy #200
and other RWMA classes of alloys to fit your needs.

It is unwise to pay too much, but it is worse to pay too little!

Use TIPALOY and get 30% to 100% more performance for your money than you are now getting.

BUY TIPALOY and get TIPALOY QUALITY

Send your trial order today

*TIPALOY #130 cast and processed under our patents.

FREE: Write for your copy of Tipaloy's comprehensive new catalog.

Distributors and Representatives: Write for complete information about available territories.

REPRESENTATIVES IN PRINCIPAL CITIES
Tipaloy INC.
1435 E. MILWAUKEE AVE
DETROIT 11, MICHIGAN

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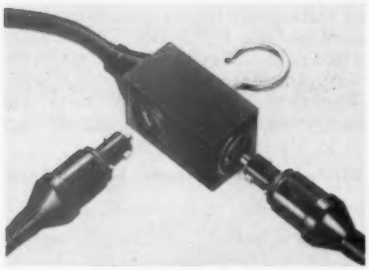
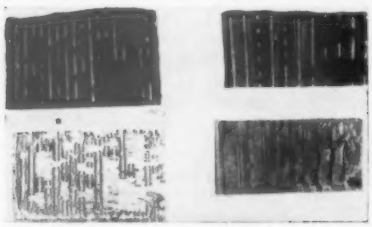


Explosionproof Plugs

Plugs and receptacles for safe, rapid connection of electrical cables in hazardous areas have been introduced by J. B. Nottingham & Co., Inc. The new Industriline plugs and receptacles are available with 2, 3, or 4 wire circuits rated as high as 240 volts, 15 amps or 120 volts, 30 amps. They are approved by the U. S. Navy for use in areas where plastics are worked.

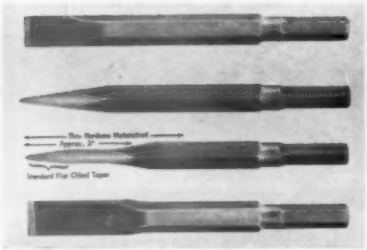
Circle No. 222 on Reader Service Card.



Inspecting Brazed Structures

Brazed structures like honeycomb can be magnetic-particle inspected with Recordaflux, developed by the Instruments Div., Budd Company. Photo shows examples of two brazed steel sandwich structures and the results of the inspection. The top squares are the skins of the brazed structure; the bottom squares show test results.

Circle No. 223 on Reader Service Card.



Chipping Chisels

Design and alloy steel combine to eliminate point reforging and hardening of GP chisels manufactured by Bedford Tool & Forging Co. Compared in the illustration are the GP point and the standard flat chisel. Popular sizes, edge widths, and lengths are available from stock.

Circle No. 224 on Reader Service Card.

For More Information Circle No. 7 on Reader Service Card.

AMERICA'S FINEST AND NEWEST MANUFACTURER OF BRAZING ALLOYS INVITES YOU TO TRY OUR ALLOYS . . .

Request samples on company letterhead. We will be happy to send you our equal to the alloys you are now using.

Write for this free catalog today.

LOW FUMING BRONZE
NICKEL SILVER
SILVER SOLDER
PHOSPHOR COPPER
PHOSPHOR SILVER
SILICON BRONZE
NICKEL BRONZE

OUR ALLOYS ARE MADE IN STRICT ACCORDANCE WITH AWS, ASTM & FEDERAL SPECIFICATIONS.

FOR NAME OF OUR NEAREST DISTRIBUTOR, WRITE TO:

American Brazing Alloys Corp.

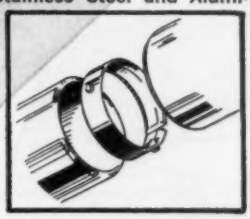
PELHAM, NEW YORK **Tel: MOunt Vernon 4-5858**

ROBVON BACKING RINGS

FAST • PRECISE TOLERANCE FIT-UPS

TYPE "CCC"

Designed for quick easy alignment of pipe where the variation in inside diameters is relatively great. Chamfered NUBS allow close tolerance fit-up and CLEAN STRIKE OFF. The ROBVON NUB automatically sets root gap. ROBVON rings are beveled to assure non-restricted fluid flow. Available in Carbon Steel, Wrought Iron, Chrome Alloys, Stainless Steel and Aluminum.



Exclusive with Robvon

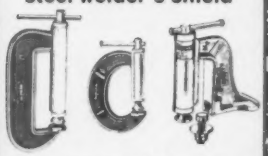
ROBVON BACKING RING CO.

Reg. Pat. Nos. 2,764,426 & 2,366,579 **675 Garden St., Elizabeth 2, N. J., PH: EL 2-9613**

For More Information Circle No. 70 on Reader Service Card.

Circle No. 1 on Reader Service Card.

Jorgensen Pony Jorgensen Pony
CLAMPS CLAMPS CLAMPS
CLAMPS with patented "Jorgensen" steel welder's shield



"C" clamps, machinist's clamps, and now hold-down clamps with POSITIVE, PERMANENT protection against "spatter" and accidental damage to clamp screw.

CLAMPS CLAMPS CLAMPS
Jorgensen Pony Jorgensen Pony
CLAMPS CLAMPS CLAMPS
Jorgensen Pony Jorgensen Pony
CLAMPS CLAMPS CLAMPS
Pony Jorgensen Pony Jorgensen
write for information on complete line
ADJUSTABLE CLAMP COMPANY
"The Clamp Folks"
419 N. Ashland Ave. Chicago 22, Ill.

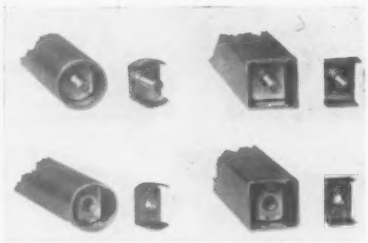
NEW PRODUCTS *continued*

New Line of Headshields

The Lincoln Electric Co. has announced a new series of headshields.

Four styles of fiberglass and polyester resin-molded shields are available. The pliable headgear easily adjusts to any head. Other features include: a metal holder that protects the lens; heat or moisture warp resistance; and abuse-resisting edge.

Circle No. 225 on Reader Service Card.



Welded Inserts for Tubing

Two-piece inserts for round, square, or rectangular tubing have been developed by Ohio Nut & Bolt Co. for manufacturers of furniture and like products. Inserts are available for tube diameters: round tubing, 1 to 1½ inches; square and rectangular tubing, ⅞ to 1½ inches in width.

Circle No. 226 on Reader Service Card.

Easy to Open

Quick-Lid is the name of Hobart Brothers Company's new mild steel electrode carton. Built-in pull tabs make the carton easy to open and, when pulled in both directions, expose the entire length of the electrode carton. The carton is said to protect electrodes better from damage, dirt, and moisture.

Circle No. 227 on Reader Service Card.

HIGHEST YIELD

They mean National Carbide's calcium carbide —gets ten tests!

Always nearby— in the **BIG RED DRUM.** Wire for supplier...

National Carbide is a product of:

Calcium Carbide

AIR REDUCTION CHEMICAL & CARBIDE CO.

A DIVISION OF AIR REDUCTION COMPANY, INCORPORATED • 150 EAST 42nd STREET, NEW YORK 17, NEW YORK • MURRAY HILL 2-8700

For More Information Circle No. 2 on Reader Service Card.

Your Welding Supply Distributor Serves You Best with these products

NEW "Y" CONNECTIONS FOR NEW I.A.A. ARGON FITTINGS

411—Righthand
412—Lefthand

Equipped with Western Brand high-quality Needle Valves with Teflon Washers & Stainless Ball-bearing Stems. 401—Righthand & 402—Lefthand also available without Needle Valves. WRITE FOR CATALOG PRICE SHEET.

"Look for the WESTERN BRAND"

Brass Fittings for the Welding Trade

WESTERN ENTERPRISES, INC.

BAY VILLAGE 40, OHIO

FREE Send for informative brochure "Welding Hose Care & Repair".

In Canada: Fibre-Metal (Canada) Ltd., Toronto

Circle No. 83 on Reader Service Card.

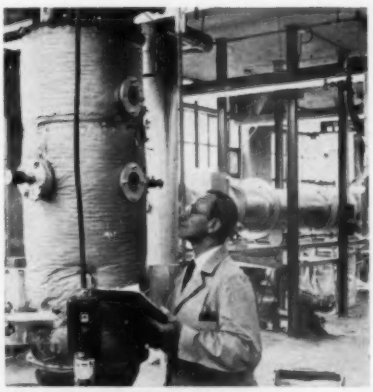
OSU Holds Summer Course on Welding Engineering

COLUMBUS, OHIO: The Department of Welding Engineering, Ohio State University, will present a summer conference course on the fundamentals of welding engineering, June 12-23. The intensive program of instruction and practice is for management, engineers, production supervisors, and technicians. No specific prerequisite training or experience is required. Cost of the course is $200.

Information can be obtained from William L. Greene, 190 West 19th Avenue, Ohio State University, Columbus 10, Ohio.

COMING EVENTS

May 8-10, 1961: National Welding Supply Association Convention, New York City.
May 9-10: National Convention of the Canadian Welding Society, Toronto, Ontario, Canada.
May 11-12: National Engineering Conference, Minneapolis.
May 22-25: Design Engineering Conference, Cobo Hall, Detroit.
June 8-9: First Western Conference of the National Electrical Manufacturers Association, Biltmore Hotel, Los Angeles.
July 18-20: Western Plant Maintenance and Engineering Show & Conference, Pan Pacific Auditorium, Los Angeles.
September 27-30: Third Biennial Industrial Exposition, Roanoke, Virginia.



ALUMINA FROM CLAY: A research technician at Olin Research Center in New Haven, Conn., checks operation of a small pilot crystallizer used in developing Olin Mathieson Chemical Corporation's economically practical process for purifying aluminum sulfate—a key step in producing alumina (the raw material of aluminum) from clay and shales.

more news on page 82

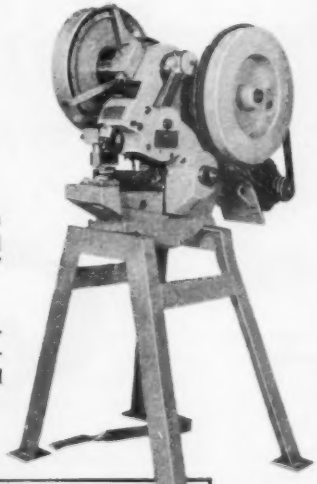
Large and Small Fabricators of steel and ornamental iron swear by it ...

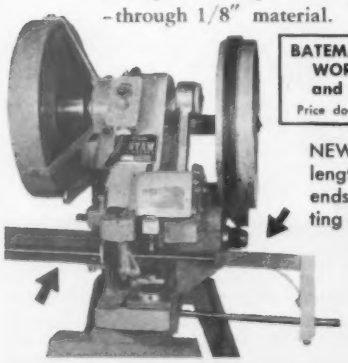
BATEMAN BANTAM IRON WORKER

The Bantam cuts and punches fast and clean . . . no grinding necessary. It's versatile, and saves time and labor! Cuts 2" x 2" x 1/4" angle and 1/4" x 4" flats.

Punches 1/2" hole through 1/4" material. Operates by hand or foot, uses 3/4 hp motor (1750) rpm., powered with flywheel and drive gear.

The Coper will cope 1-1/4" through 1/8" material.





BATEMAN BANTAM IRON WORKER, with motor and stand $575.00
Price does not include Blades, Punches or dies.

Shp. Wt. 750 lbs.

NEW ACCESSORIES: Gauge for cutting to length, Guide for Flat Bars for cutting on ends, and Angle Iron Trimming Guide, for cutting at a 45 degree. Write for details.

WRITE TODAY for complete information and name of nearest distributor

Bateman Foundry & Machine
MINERAL WELLS, TEXAS

For More Information Circle No. 16 on Reader Service Card.

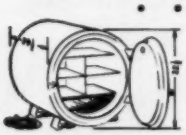
END THIS COSTLY AFFAIR BY KEEPING YOUR RODS AT HOME *in*

PHOENIX DryRod®

ELECTRODE OVENS

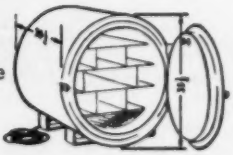
Pioneer and Leader in the Field

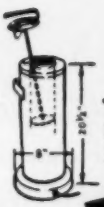
Dry Rod is the Trademark of Good welding everywhere



TYPE 300
350 lb size

TYPE 900
1100 lb size





TYPE 10
Portable
10 lb size

Also available: Type 1000 (800° or 1000°) High temperature Re-baking ovens

Welding electrodes are a perishable product. Reworks are extremely costly. Insure good welds with Dry Rod Ovens. Write for folder "Dry Rod as Standard Welding Equipment".

PHOENIX PRODUCTS COMPANY
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American Cryogenics' Calox Division Largest In West

WITH THE PURCHASE of the Burdett Oxygen Company's California facilities, plus the leasing of Victor Equipment Company's manufacturing plants in La Habra and Sacramento, California, California Oxygen Company (Calox) now becomes the largest independent producer of liquid and gaseous oxygen, nitrogen, argon, and acetylene and hydrogen gases in the 11 western states.

According to Pierce E. Marks, Sr., president of American Cryogenics Corp., these California acquisitions, with their large tonnage plants for the manufacture of these gases, is another step in the continued diversification of the American Cryogenics operation.

Other officers of the California Oxygen Company are M. F. Coyne, executive vice president; L. W. Fleischer, executive vice president; Pierce E. Marks, Jr., vice president; J. P. Coyne, secretary.

THIS NEW PLANT, warehouse, and office building will be built this year by Atlas Welding Accessories, Inc., on Stephenson Highway, Troy, Michigan, a suburb of Detroit. The building is scheduled for completion on October 1st. This will be Atlas' fourth move to new and larger quarters in 24 years.

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For More Informaiton Circle No. 71 on Reader Service Card.

Data Offered in This Month's Ads

Readers may obtain any of these free reference materials by circling the corresponding numbers on the Reader Service Cards

1: Hold-down clamps are featured. Adjustable Clamp Co.

2: Calcium carbide is featured. Air Reduction Chemical & Carbide Co.

3: Flame cutting supplies and equipment is available. Air Reduction Sales Co.

4: Double-barrelled tip holder is featured in literature. Air Reduction Sales Co., Tuffaloy Dept.

5: Spooled wire is described in literature. All-State Welding Alloys, Inc.

6: Welding wire for high strength welds are described in a bulletin. Alloy Rods Company.

7: Brazing alloys are listed in a catalog. American Brazing Alloys Corp.

8: A safety hat to meet all requirements is described in folder S-1456. American Optical Co.

9: Beveler is featured in literature. American Pullmax Co., Inc.

10: Overlaying electrodes are described in bulletin W-17. Ampco Metal, Inc.

11: Removal of dust, smoke, or fumes is featured in literature. The Arcair Company.

12, 13: EB weld inserts are described in literature. Arcos Corporation.

14: Bandsaw design and operation is discussed. Armstrong-Blum Mfg. Co.

15: Abrasive cutting machines are listed in a catalog. Beaver Pipe Tools, Inc.

16: Iron workers and accessories are described in data. Bateman Foundry & Machine.

17: Reinforced resinoid disc-wheels are described in literature. Bay State Abrasive Products Co.

18: Carbon arc gouging is featured in literature. Becker Brothers Carbon Co.

19: Power connectors are described in catalog. Cam-Lok Div., Empire Products, Inc.

20: Oxide scale problems are discussed. Chemclean Products Corp.

21: Clamps for all jobs are described in a catalog. Cincinnati Tool Co.

22: Blowtorches that use natural, manufactured, or LP gas are described. Clements Mfg. Co.

23: A tong-type a.c.-d.c. ammeter is featured in material. Columbia Electric Mfg.

24: Pipe layout equipment is featured. Contour Sales Corp.

25: Acetylene cylinders are featured. Coyne Cylinder Company.

26: Helmets and handshields are listed in catalog. Dockson Corp.

27: Electrode holders are featured. Duro Engineering Co.

28: Industrial heaters are described in brochure. Electric Arc, Inc.

29: One welder for TIG or manual stick electrode welding is described in selector guide. Emerson Electric.

30: Arc welding accessories and welding circuits are explained. Erico Products Inc.

32: Controlled angle TIG welding torch is described in catalog. Falstrom Co.

33: Welding helmets and accessories are tured. Fibre-Metal Products Co.

34: Extra strength alloy steels are featured. Great Lakes Steel.

35: Axle assemblies, jacks, couplers, and spindles are illustrated in catalog. Hammer Blow Tool Co.

36: Welding equipment is listed in a catalog. Harnischfeger Corp.

37: Controlled flame cutting is described in literature. Heath Engineering Co.

38: Resistance welding alloys and tips are featured. Hercules Welding Products.

39: Welders of all types and sizes are listed in a catalog. Hobart Brothers Co.

continued on page 84

QUIK-HEAT

up to 2200° F.

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MODELS K3 & M2

BLOWTORCHES

Here are rugged, high efficiency blowtorches that speed up all types of heat treating and production operations. These two Clements Cadillac Blowtorches provide heat up to 2200°F. in seconds and are fully portable.

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Hickory 5-2330

INDUSTRIAL CHEMICALS AND SPECIALTIES

Circle No. 20 on Reader Service Card.

DATA FEATURED IN ADS

continued from page 83

40: Liquefied gas storage and transport vessels are featured. **Hofman Labs., Inc.**

41: Iron bender with 147 dies is featured in a bulletin. **Hossfeld Mfg. Co.**

42: Eye, face and head protection is discussed. **Glendale Optical Co.**

43: Electrode holders are listed in catalog. **Jackson Products.**

44: Consult your welding supply distributor about welding problems. **Lenco, Inc.**

45: King-size facilities are described in literature. **Lewis Welding & Engineering Co.**

46: Welding equipment and accessories are featured in a catalog. **Lincoln Electric Company.**

47: Welding distributors and how they serve local needs are explained. **Linde Co.**

48: Welding helmets (eight different types) are featured. **Linde Co.**

49: Welding and cutting apparatus is described in a catalog. **Liquid Carbonic, Division of General Dynamics.**

50: Facilities, capacities, and new fabricating techniques are featured. **R. C. Mahon.**

51: Temperature indicators in adjustable holders are described. **Markal Co.**

52: Flame-cutting machines of a complete line are described. **American Messer Corp., Cutting Machine Division.**

53: Reclaiming with metal spray guns is featured. **Metallizing Company of America.**

54: Galvanizing welds is the subject of data which includes a sample. **Metalloy Products Co.**

55: Flame spraying hard facing is described in a bulletin. **Metco, Inc.**

56: Nationally known facilities, experience and craftsmanship are described in literature. **Morgan Engineering Co.**

57: Forge hammers are featured in literature. **D. J. Murray Manufacturing Co.**

59: Shape cutting machines are featured in literature. **Ohmstede Machine Works, Inc.**

60: Metal hardness tester is featured. **Pacific Transducer Corp.**

61: Welding wire comparison chart and color code identification card is available. **Page Steel & Wire Division, American Chain & Cable Co., Inc.**

62: Electrode ovens are subject of folder. **Phoenix Products Co.**

63: Flaw-hunting kit is featured. **Picker X-Ray Corp.**

64: Finding defects is discussed. **Picker X-Ray Corp.**

65: Non-destructive testing is featured. **Picker X-Ray Corp.**

66: Seamless high-pressure cylinders are described in a catalog. **Pressed Steel Tank Co.**

67: Leakproof hose connections are described in catalog. **Punch-Lok Co.**

68: Hard facing electrodes are featured. **Rankin Manufacturing Co.**

70: Backing rings for pipe welding are featured. **Robvon Backing Ring Co.**

71: Carbide is featured in literature. **Shawinigan Products Corp.**

72: Safety screens, gloves, and safety clothes are featured in a catalog. **Singer Glove Mfg. Co.**

73: All position electrode is featured in literature. **A. O. Smith Corp.**

74: Cut-off machines are featured in literature. **Stone Machinery Co., Inc.**

75: Automatic welding machines are featured. **Stoody Company.**

76: Repointing shovel teeth is described. **Stulz-Sickles Co.**

77: Tungsten electrodes for every purpose are featured. **Sylvania Electric Products, Inc.**

78: Miniature torches are featured. **Tec Torch Co., Inc.**

79: Electrodes for resistance welding are listed in a catalog. **Tipaloy, Inc.**

80: Electrode holders with ball point cable connection are featured. **Tweco Products, Inc.**

81: Welding rods for build-up or attachment are featured. **Victor Equipment Co.**

82: Metal tubing notcher is featured in literature. **Vogel Tool & Die Corp.**

83: Argon fittings are subject of catalog. **Western Enterprises Inc.**

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Cost of all ads in this section is $20 for the first inch and $15 for each additional inch or fraction thereof. Rates for display ads in this section will be sent on request. All classified advertising payable in advance.

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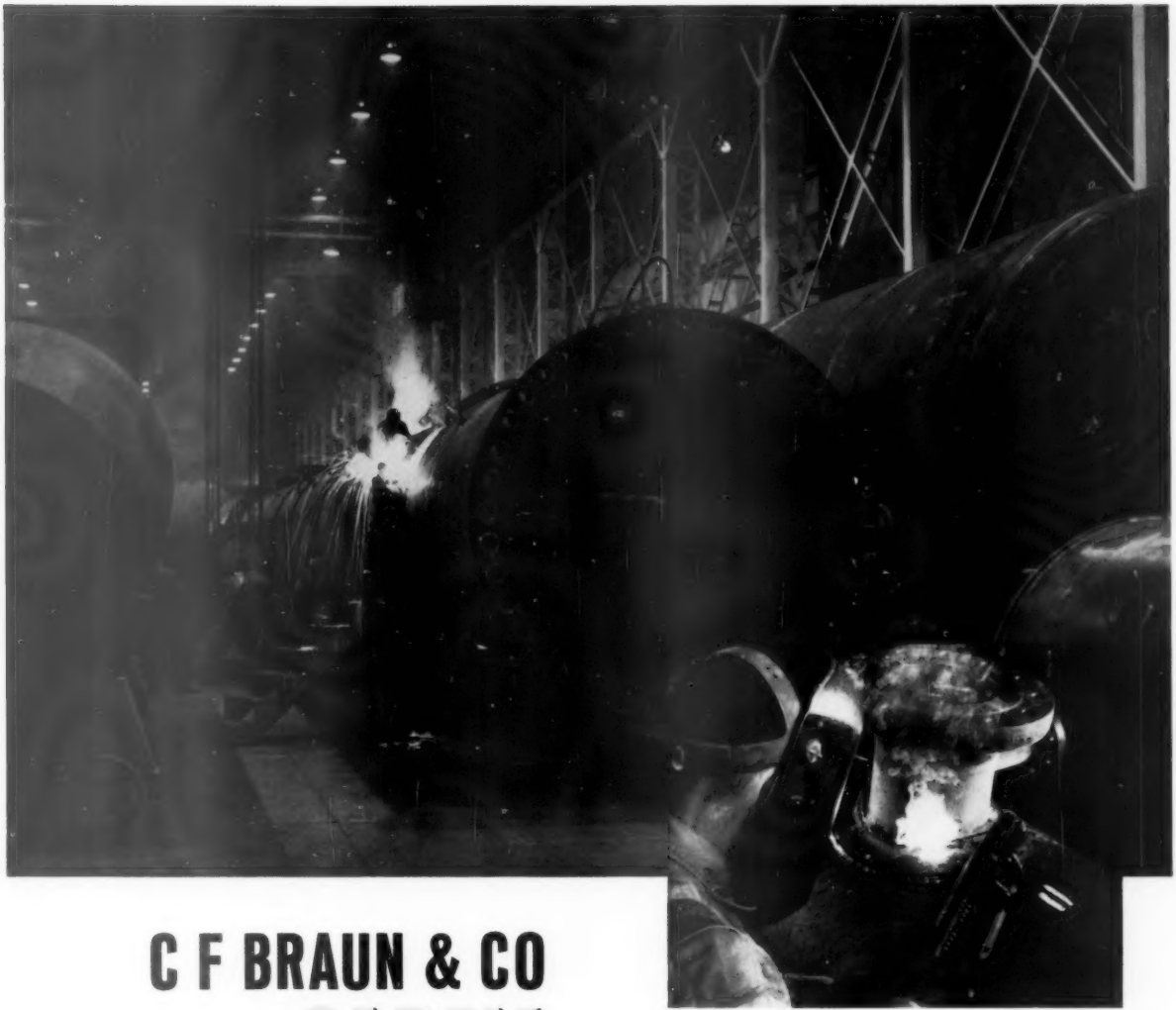

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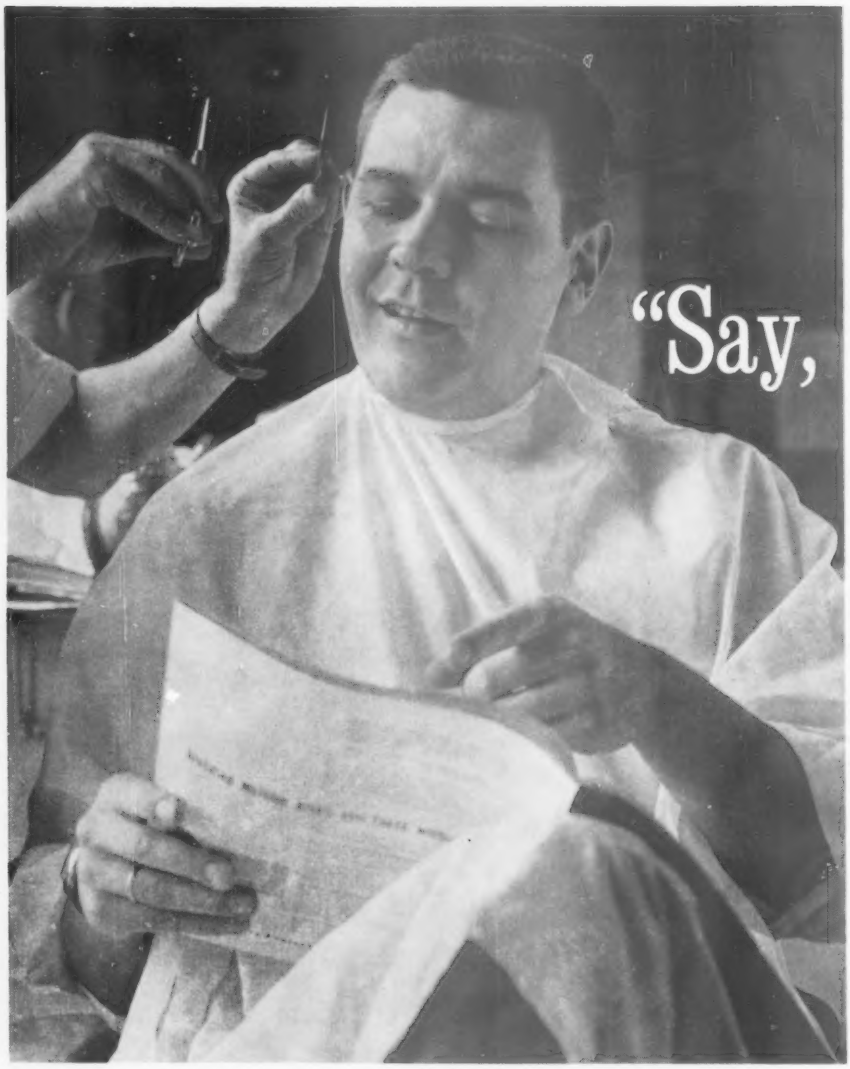

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